

# Exhibit D

## Part 1

1 UNITED STATES PATENT AND TRADEMARK OFFICE  
2 BEFORE THE PATENT TRIAL AND APPEAL BOARD  
3

4  
5 \_\_\_\_\_  
6 EMC CORPORATION,

7 Petitioner,

8 v.

9 ACQIS LLC,

10 Patent Owner.  
11 \_\_\_\_\_

12 Case IPR2014-01462 (Patent 8,041,873 B2)

13 Case IPR2014-01469 (Patent RE42,814 E)  
14

15 Thursday, August 27, 2015  
16

17 Volume I of II  
18

19 Deposition of VOLKER LINDENSTRUTH, taken at the  
20 offices of Gibson, Dunn & Crutcher, Carmelite House, 50  
21 Victoria Embankment, London EC4Y 0DZ, beginning at  
22 8:57 a.m. before Audrey Shirley, QRR, ACR, MBIVR.  
23  
24  
25

A P P E A R A N C E S

FOR THE PETITIONER

GIBSON, DUNN & CRUTCHER LLP

1050 Connecticut Avenue, N.W.

Washington, DC 20036-5306

BY: BRIAN M. BUROKER, ESQ.,

Tel: +1 202 955 8541

Email: bburoker@gibsondunn.com

FOR THE PATENT OWNER

COOLEY LLP

380 Interlocken Crescent

Suite 900

Broomfield, Colorado 80021-8023

BY: BRITTON F. DAVIS, ESQ.,

Tel: +1 720 566 4126

Email: bdavis@cooley.com

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

I N D E X

Witness	Examination	Page
Volker Lindenstruth	(By Mr. Buroker)	4

E X H I B I T S

Exhibit No.	Description	Page
No. 1027	Document entitled "SCI implementation study for LHCb Data Acquisition."	99

1	VOLKER LINDENSTRUTH, having been duly sworn, was	
2	examined and testified as follows:	
3		08:57:36
4	MR. BUROKER: For the record we should	08:57:36
5	probably announce ourselves. My name is Brian	08:57:38
6	Buroker from Gibson, Dunn & Crutcher, I represent	08:57:41
7	the petitioner in both proceedings, EMC.	08:57:42
8	MR. DAVIS: My name is Britton Davis,	08:57:47
9	I'm with Cooley LLP, I represent the patentholder	08:57:48
10	in both proceedings.	08:57:54
11	THE WITNESS: I am Volker Lindenstruth,	08:57:56
12	I am the witness.	08:57:58
13	EXAMINATION	08:58:00
14	BY MR. BUROKER:	08:58:00
15	Q. For the record, Dr. Lindenstruth,	08:58:00
16	would you please state your full name?	08:58:03
17	A. Professor Dr. Volker Lindenstruth,	08:58:05
18	born in Frankfurt 1962, October 8th.	08:58:07
19	Q. And please state your full	08:58:15
20	business address?	08:58:16
21	A. I have several business addresses.	08:58:23
22	The primary office is in Frankfurt, it is	08:58:26
23	Ruth-Moufang Street. "Ruth" as "Ruth" dash	08:58:31
24	M-o-u-f-a-n-g Street No. 1 in Frankfurt. The zip	08:58:40
25	code I don't remember off the top of my head. If	08:58:43



1	IPR2014-01469; is that correct?	09:00:45
2	A. Yeah.	09:00:49
3	Q. And for the '873 Patent, the IPR	09:00:49
4	proceeding is IPR2014 01462; is that correct?	09:00:53
5	A. Okay, I didn't remember them	09:00:57
6	therefore I just checked.	09:00:59
7	Q. And you understand that your	09:01:00
8	testimony, although given here in the United	09:01:03
9	Kingdom, is as if you were giving testimony in	09:01:06
10	the United States, correct?	09:01:08
11	A. That's correct, yeah.	09:01:09
12	Q. And so that your testimony is	09:01:11
13	subject to penalty of perjury under the United	09:01:15
14	States law. Is that your understanding?	09:01:18
15	A. I understand that.	09:01:19
16	Q. Have you been deposed before?	09:01:20
17	A. In this kind of context, no.	09:01:23
18	Q. Is there another kind of context	09:01:25
19	in which you have been deposed?	09:01:27
20	A. I have been involved in several	09:01:29
21	cases of IP law where laws about compliance with	09:01:31
22	certain products and so forth, but never in such	09:01:39
23	a case, with a cross-examination.	09:01:43
24	Q. Were any of those cases related to	09:01:45
25	court proceedings in the United States?	09:01:49

1	A. No.	09:01:51
2	Q. Were those cases involving court	09:01:51
3	proceedings in Germany?	09:01:54
4	A. Leading to, yeah. But --	09:01:57
5	Q. What do you mean -- well, were you	09:02:01
6	finished? I'm sorry.	09:02:04
7	Well, let me step back a minute. Since	09:02:04
8	you haven't been involved in a deposition, I'm	09:02:07
9	sure your counsel went over this with you but let	09:02:10
10	me explain the process and so forth. I'll ask	09:02:13
11	a question and if you don't understand my	09:02:16
12	question please let me know that you didn't	09:02:18
13	understand it so I can clarify, is that fair?	09:02:21
14	A. Sure.	09:02:23
15	Q. If you don't say anything I'm	09:02:24
16	going to assume you understood my question. The	09:02:27
17	second thing is because this court reporter is	09:02:30
18	doing a very good job and trying to keep track of	09:02:32
19	the questions and answers, it's important that	09:02:34
20	you wait for me to finish and I'll wait for you	09:02:36
21	to finish your answer and I apologize I may have	09:02:38
22	interrupted your last answer. So if you we can	09:02:41
23	try to do that it will make everything easier on	09:02:44
24	everybody involved, okay.	09:02:48
25	Is there any reason why you can't give	09:02:49



1	truthful testimony here today?	09:02:52
2	A. I'm not aware of any.	09:02:53
3	Q. No medications or anything that	09:02:54
4	you may be taking that would impair your ability	09:02:56
5	to testify truthfully?	09:02:58
6	A. No.	09:03:00
7	Q. Okay. So going back, what is the	09:03:00
8	nature of the proceedings in which you have given	09:03:07
9	testimony in the past?	09:03:10
10	A. Most cases are in the context of,	09:03:13
11	for example, we are spending a lot of money	09:03:18
12	buying computers, you have the public tender, you	09:03:24
13	set forth documents, what the product has to	09:03:29
14	comply with, product not being delivered and not	09:03:31
15	being delivered according to spec and then you	09:03:35
16	get into a fight with a vendor and normally it's	09:03:37
17	being resolved, sometimes not, and then you	09:03:41
18	prepare your way to the court. That's one	09:03:45
19	example.	09:03:47
20	Another example, product being delivered	09:03:48
21	and then turns out that there is a patent by	09:03:50
22	another vendor which prevents this product from	09:03:54
23	being used which of course is not a funny thing	09:03:57
24	to be once you've paid the product already, and	09:03:59
25	we're talking usually minimum €100,000 and more.	09:04:03

1 And then you prepare the case. 09:04:08

2 In most cases we could avoid going all 09:04:12

3 the way and settled one or the other way but, of 09:04:16

4 course, in order to get such a case without you 09:04:20

5 have to prepare it as if it was to go to court. 09:04:25

6 Q. So, breaking that down a little 09:04:30

7 bit, you have been involved in cases in which 09:04:34

8 companies or businesses you've been involved with 09:04:37

9 were accused of patent infringement; is that 09:04:40

10 correct? 09:04:43

11 A. In this one case there was no 09:04:45

12 direct infringement case yet raised, but I had 09:04:50

13 purchased a product for close to €200,000 where 09:04:53

14 subsequently the patent was issued in Germany 09:04:58

15 which prevented us to use that product. Since we 09:05:02

16 are public sector we can't just ignore the 09:05:05

17 existence of a patent and wait for the injunction 09:05:08

18 by the patent owner to stop us, right? I mean we 09:05:11

19 have high standards being the government. So 09:05:15

20 that had to be resolved. 09:05:18

21 Q. And in that proceeding did you 09:05:20

22 give testimony in court? 09:05:22

23 A. It didn't get that far 09:05:23

24 fortunately -- 09:05:25

25 Q. Have you -- 09:05:26

1	A. -- that case.	09:05:26
2	Q. Oh sorry. Have you given	09:05:28
3	testimony in court proceedings anywhere in the	09:05:29
4	world before?	09:05:34
5	A. Once in Germany that was a suit	09:05:35
6	introduced by the University of Heidelberg	09:05:39
7	against somebody who basically copied an entire	09:05:43
8	class I did into a book under his own name, which	09:05:47
9	obviously was not a good thing to happen, in	09:05:51
10	particular because then later I had students	09:05:53
11	argue that I plagiarized the authors of that	09:05:57
12	particular book. That was the moment when I said	09:06:02
13	that had to stop. The publishing house refused	09:06:04
14	to do any remedy, so it went to court, the full	09:06:09
15	proceeding. And since this is a -- the judge	09:06:16
16	made it absolutely clear that this was	09:06:23
17	plagiarism, but since this is about teaching and	09:06:30
18	textbooks, in Germany there is a law which says	09:06:33
19	knowledge must not be prevented from being taught	09:06:39
20	by any copyrights. So he could not say whether	09:06:42
21	or not by destroying that book he would prevent	09:06:47
22	the teaching inside the book as the abstract	09:06:51
23	teaching from still being taught. The judge	09:06:54
24	suggested that we take this to the Supreme Court	09:06:58
25	because that was an open case for Germany, which	09:07:00

1 the university wouldn't do for cost, and the case 09:07:04  
2 was settled that the publishing house committed 09:07:08  
3 to not selling this book -- only selling the 09:07:13  
4 already printed versions and signed a document 09:07:16  
5 that this book was an infringement -- was 09:07:18  
6 plagiarism, which was enough for me because then 09:07:23  
7 I could clearly document that I wasn't the one 09:07:25  
8 doing this. But this was an entirely different 09:07:28  
9 kind of proceeding like we have here. 09:07:31  
10 Q. Right. So in that case you were 09:07:35  
11 testifying as a fact witness, a person of 09:07:37  
12 knowledge of the facts as opposed to an expert 09:07:41  
13 witness; is that correct? 09:07:44  
14 A. So to say, yeah. 09:07:45  
15 Q. Have you ever testified as 09:07:47  
16 an expert in any proceedings anywhere in the 09:07:49  
17 world? 09:07:53  
18 A. Like this, no. 09:07:53  
19 Q. Sir, when were you engaged to 09:07:54  
20 assist Acqis in connection with these 09:08:00  
21 proceedings? 09:08:05  
22 A. This is quite a while ago. I 09:08:07  
23 believe roughly October last year, September, 09:08:10  
24 October last year, the exact date I do not 09:08:18  
25 remember. If you wish to have that date I would 09:08:21

1	have to go through my email records which I don't	09:08:23
2	have here. I could give this to you later.	09:08:26
3	Q. Have you assisted Acqis in	09:08:29
4	connection with any of the pending litigation	09:08:36
5	matters as opposed to these two IPR proceedings?	09:08:37
6	A. No. Not as far as these documents	09:08:40
7	go or anything, no.	09:08:48
8	Q. Have you reviewed any confidential	09:08:50
9	information of the petitioner EMC that was	09:08:54
10	produced in the litigation?	09:09:00
11	A. No.	09:09:01
12	Q. Have you reviewed any confidential	09:09:02
13	information of Alcatel-Lucent from the	09:09:04
14	Acqis-Alcatel-Lucent litigation?	09:09:13
15	A. I am not aware having seen that or	09:09:16
16	even having heard about that. I am aware that	09:09:17
17	there are things like that ongoing, but this is	09:09:20
18	entirely out of the scope of my work here and the	09:09:25
19	context in which we performed that work.	09:09:27
20	Q. Right and I'm just trying to get	09:09:29
21	an understanding of what you did or didn't review	09:09:34
22	since your engagement, so that's why I asked the	09:09:37
23	question whether you had reviewed any	09:09:41
24	confidential information of either EMC or	09:09:43
25	Alcatel-Lucent. And so the answer is no, you	09:09:45

1	have not?	09:09:48
2	A. But for my understanding this is	09:09:49
3	confidential information, it would be not even	09:09:51
4	okay to give it to me, right?	09:09:54
5	Q. Well ...	09:09:59
6	A. You're kind of asking me whether I	09:10:01
7	wrongfully saw a document.	09:10:03
8	Q. No, there are Protective Orders in	09:10:04
9	the litigation that enable experts engaged by	09:10:06
10	Acqis to see information, and we're not aware	09:10:10
11	that you were provided information, but that's	09:10:14
12	why I wanted to confirm you were not provided	09:10:17
13	information under the terms of that Protective	09:10:19
14	Order?	09:10:21
15	A. No.	09:10:24
16	Q. No.	09:10:25
17	(Brief off-the-record discussion.)	09:12:49
18	BY MR. BUROKER:	09:12:54
19	Q. It looks like you've got copies,	09:12:54
20	and maybe these are the exact same things, but I	09:12:56
21	was going to provide you copies with --	09:12:58
22	A. Then I will take both, that's	09:12:58
23	fine.	09:12:58
24	Q. -- Acqis Exhibit 2021 in both	09:13:01
25	proceedings, so there's two different documents	09:13:04

1 but it's 2021 from the 1469 proceeding and 2021 09:13:06  
2 from the 1462 proceeding as well. And I think 09:13:12  
3 they're probably the same as what you have. 09:13:16  
4 Do you need a copy? 09:13:18  
5 MR. DAVIS: Do you have the super nice 09:13:20  
6 bound one? If you do, I would love that. Thank 09:13:24  
7 you. 09:13:26  
8 MR. BUROKER: I don't know how nice 09:13:32  
9 they are, but ... 09:13:34  
10 MR. DAVIS: Thank you. 09:13:35  
11 BY MR. BUROKER: 09:13:35  
12 Q. So you recognize these two 09:13:41  
13 documents as printouts of the declaration that 09:13:43  
14 you signed and submitted in connection with the 09:13:49  
15 two proceedings? And I'm not giving you a - 09:13:50  
16 test. I'll represent that we believe they're 09:13:56  
17 full copies of each. 09:13:58  
18 A. With this disclaimer absolutely, 09:14:01  
19 yes, I recognize them. 09:14:03  
20 Q. How were these documents drafted? 09:14:04  
21 Did you write all the words in the document? 09:14:17  
22 A. I did not write all the words in 09:14:20  
23 there, hardly ever do that. I mean I've reviewed 09:14:22  
24 all the material and we have come to conclusions, 09:14:31  
25 there have been discussions with Cooley and the 09:14:37

1 documents were jointly written. I have reviewed 09:14:41  
2 them several times very carefully, I have read 09:14:44  
3 them, both of them, all 250 altogether pages. 09:14:47  
4 Let me see the first one is about, I believe, 09:14:52  
5 roughly 100 pages, 93, plus an appendix, the 09:14:54  
6 other is 114, something like that, 111. I 09:14:59  
7 carefully read them to make sure that everything 09:15:03  
8 in there is correct and I still believe so today 09:15:07  
9 except for some very minor typos which we found, 09:15:12  
10 a few commas and so forth, nothing which really 09:15:16  
11 has any effect on the content of these documents. 09:15:20  
12 Q. So you worked together with 09:15:24  
13 Acqis's counsel at Cooley to draft these 09:15:27  
14 materials but you reviewed them and signed them 09:15:30  
15 as your statement, correct? 09:15:34  
16 A. Well, I mean the message in here, 09:15:35  
17 this is from -- is mine, right? And they helped, 09:15:38  
18 of course, to do a lot of the detail work, for 09:15:47  
19 example make sure all the references are right. 09:15:51  
20 Q. And were you compensated for your 09:16:01  
21 time in connection with these two proceedings? 09:16:03  
22 A. Yes. 09:16:07  
23 Q. Okay. And what is the hourly rate 09:16:07  
24 at which you were being compensated? 09:16:09  
25 A. €250. 09:16:11



1 Q. Per hour, correct? 09:16:13

2 A. Yeah. 09:16:17

3 Q. How many hours have you spent 09:16:18

4 since your engagement to date on this effort? 09:16:23

5 A. I would have to look up my 09:16:28

6 records, I don't remember the exact number. 09:16:32

7 Altogether, up to date, 50 hours, maybe 60, let's 09:16:35

8 say, plus or minus 10, 20 percent. If you want 09:16:44

9 the exact number I would have to check my 09:16:48

10 records. 09:16:51

11 Q. Approximate is fine. 09:16:53

12 Do you recall how much time you worked 09:16:59

13 on each of the two different declarations? 09:17:01

14 Roughly 50/50? 09:17:05

15 A. That I can't tell. A lot of 09:17:08

16 material is relevant for both and, as you 09:17:12

17 noticed, there is quite a bit of similarity 09:17:17

18 between these two documents, so it is hard to say 09:17:19

19 how to break this up between the two. 09:17:23

20 Q. And what did you do to prepare for 09:17:28

21 your deposition today? 09:17:34

22 A. You mean after submitting these 09:17:38

23 documents? 09:17:39

24 Q. Correct. 09:17:40

25 A. I read them several times again to 09:17:44

1 refresh my memory. I read the patents, the prior 09:17:47  
2 arts not every page, there's a lot of material. 09:17:55  
3 And I had a few discussions with Cooley to tell 09:17:59  
4 me how this is working because this is obviously 09:18:07  
5 different from a normal conversation. 09:18:11  
6 Q. And how many times did you meet 09:18:14  
7 with counsel for Cooley to prepare for your 09:18:19  
8 deposition? So just the conversations you had 09:18:21  
9 with them relating to preparing for today. And I 09:18:25  
10 don't want to know the substance, you know, I 09:18:31  
11 just want to know how many times. 09:18:33  
12 A. Now, I didn't really try to keep 09:18:40  
13 track of this particular element, so I have to 09:18:42  
14 rethink this and this will not be a very accurate 09:18:44  
15 answer. Three, four times. 09:18:48  
16 Q. Well, those three or four times 09:18:52  
17 were some of them on the telephone and were some 09:18:57  
18 of them in person or were they all in person? 09:19:00  
19 A. When we are getting close, in 09:19:02  
20 person. 09:19:03  
21 Q. And in total how many hours would 09:19:04  
22 you say you spent to prepare for the deposition 09:19:07  
23 over the course of those three or four meetings? 09:19:10  
24 Estimates are fine. 09:19:19  
25 A. Fifteen. Maybe 20, maybe less. I 09:19:21

1	mean that relates now to the question of the	09:19:24
2	total amount of time I spent and the more	09:19:27
3	detailed numbers you try to make me give, the	09:19:30
4	more the sum will possibly not match because all	09:19:32
5	the errors will become larger and larger.	09:19:36
6	Q. In your declarations you	09:19:41
7	identified material that you considered, starting	09:19:44
8	-- I mean in both of the declarations	09:19:49
9	approximately it's on page 5. Well, 3, 4 and 5.	09:19:52
10	Since you submitted these declarations,	09:20:01
11	in the course of preparing for your deposition,	09:20:03
12	did you review any additional materials beyond	09:20:06
13	what's listed?	09:20:09
14	A. At this moment nothing comes to my	09:20:13
15	mind. I don't think so.	09:20:15
16	Q. Did you have any communications	09:20:19
17	with anybody? After the declarations were	09:20:21
18	submitted but before your deposition, did you	09:20:27
19	have any communications with anybody other than	09:20:29
20	counsel to prepare for your deposition?	09:20:30
21	A. No, I don't think so. I don't	09:20:34
22	remember any.	09:20:37
23	Q. You never spoke to Dr. Chu, for	09:20:37
24	example, of Acqis?	09:20:41
25	A. No.	09:20:43

1 Q. You didn't speak to any of your 09:20:43  
2 colleagues associated with what's called the 09:20:44  
3 Bogaerts reference? 09:20:46  
4 A. After the submission I did not, 09:20:49  
5 and I believe we have a non-disclosure agreement 09:20:50  
6 with Cooley so I even can't do that, right? I 09:20:55  
7 mean this proceeding is confidential, I can't 09:21:00  
8 talk to anybody. This whole context. 09:21:04  
9 Q. All right, but you didn't talk to 09:21:06  
10 anybody? 09:21:07  
11 A. (The witness shook his head.) 09:21:10  
12 Q. Did you also review the Patent 09:21:17  
13 Owner Response filed by Acqis that was submitted 09:21:21  
14 to the Patent and Trademark Office at the same 09:21:25  
15 time at your declarations? 09:21:28  
16 A. I have read that, both responses 09:21:30  
17 for both patents and -- yeah. 09:21:32  
18 Q. Did you review them before they 09:21:36  
19 were submitted to the Patent and Trademark 09:21:38  
20 Office? 09:21:40  
21 A. I'm not quite sure. I may have 09:21:46  
22 seen an early version. I'm quite sure I have not 09:21:50  
23 seen the final version and if so it was very late 09:21:53  
24 anyway. 09:21:59  
25 Q. You are aware that those Patent 09:22:02

1	Owner Responses cite to your declarations,	09:22:04
2	correct?	09:22:08
3	A. Yeah.	09:22:09
4	Q. And did you believe when you	09:22:10
5	reviewed the Patent Owner's Response that the	09:22:14
6	citations to your declaration were fair	09:22:18
7	representations of your declarations?	09:22:21
8	A. Yes, I believe so.	09:22:24
9	Q. Okay. Was there anything in the	09:22:26
10	Patent Owner's Responses that you didn't agree	09:22:31
11	with?	09:22:33
12	A. I don't remember anything at this	09:22:33
13	point.	09:22:35
14	Q. In preparing your declarations,	09:22:35
15	outside of attorneys for Cooley -- just so I've	09:22:44
16	got a clear record, I'm not sure if I got a clear	09:22:47
17	record, it was my fault -- in preparing the	09:22:49
18	declarations, other than counsel for Cooley, did	09:22:52
19	you speak to anybody else to gain facts or	09:22:54
20	information to help you make your declaration in	09:22:58
21	this case?	09:23:00
22	A. I only contacted one person in	09:23:07
23	this context and that is Hans Müller who is	09:23:09
24	co-author on the RD24, on the, as you call it,	09:23:17
25	Bogaerts reference about his recollection of the	09:23:20

1 public dissemination of that document. That was 09:23:26  
2 all. 09:23:29

3 Q. Did you mention that you spoke to 09:23:29  
4 Dr. -- is it Dr. Müller or is he mister? 09:23:31

5 A. Doctor. 09:23:35

6 Q. Doctor. Did you mention that 09:23:36  
7 you'd spoken to Dr. Müller in your declaration? 09:23:37  
8 I didn't see it. 09:23:43

9 A. I believe not. I tried to get 09:23:44  
10 something concrete from him, I didn't, so there 09:23:48  
11 wasn't any point mentioning it. 09:23:51

12 Q. What did you try to get that was 09:23:53  
13 concrete from him? 09:23:54

14 A. Whether he remembered the exact 09:23:56  
15 date when it was put on to the CERN internet so 09:23:58  
16 that it was accessible to everybody. 09:24:04

17 Q. He could not remember? 09:24:07

18 A. No. 09:24:10

19 Q. And he didn't have any information 09:24:10  
20 that he provided to you that would say one way or 09:24:12  
21 the other when it was put on that server? 09:24:15

22 A. The message was, "It's almost 09:24:22  
23 20 years ago, how could I remember?" And, I 09:24:24  
24 mean, I put forth in my declaration quite a bit 09:24:28  
25 of text, and maybe we should go through this, 09:24:33

1           what we can say, what we cannot say and so forth.           09:24:37

2           This is what basically came out of that.           09:24:40

3                   Q.     One question about the materials           09:24:43

4           you did consider. One of them, the item that's           09:24:52

5           listed in both declarations is the 2012 Federal           09:24:55

6           Circuit Bar Association Model Patent Jury           09:24:59

7           Instructions. Do you recall why you looked at           09:25:02

8           those?           09:25:04

9                   A.     In order to understand what           09:25:06

10          principles are to be applied and I mean this is           09:25:09

11          one of the reasons why I put all of this into           09:25:14

12          this document to make clear what are the           09:25:17

13          principles which we had used in the analysis in           09:25:19

14          this declaration.           09:25:22

15                  Q.     You understand that these two           09:25:24

16          Acqis patents are part of a large family of           09:25:28

17          patents that is owned by Acqis; is that correct?           09:25:31

18          Do you understand that?           09:25:34

19                  A.     Yes.           09:25:35

20                  Q.     You didn't list having reviewed           09:25:35

21          any of the other patents or patent           09:25:40

22          file histories; is that correct?           09:25:43

23                  A.     Well, the list is quite long,           09:25:45

24          we would have to go through this but if you say           09:25:46

25          so I believe you.           09:25:48

1                   Q.    Do you know why you didn't look at                   09:25:53  
2                   any materials from any of the related patents or               09:25:55  
3                   file histories?   09:25:59  
4                   A.    I mean I was asked to form                               09:26:00  
5                   an opinion about the case raised against these                   09:26:04  
6                   two patents, whether or not they are valid or not               09:26:08  
7                   valid and this is what I did. And for my                       09:26:11  
8                   analysis I used everything which I thought was                   09:26:15  
9                   relevant and this didn't seem to be relevant in                   09:26:18  
10                  order to also limit the amount of time which went               09:26:26  
11                  into this.   09:26:29  
12                  Q.    For both declarations I noticed                           09:26:33  
13                  that you did not provide a copy of your CV; is                   09:26:37  
14                  that correct?   09:26:37  
15                  A.    There is a short version of it in                           09:26:43  
16                  here under Section II, for instance, in the                   09:26:54  
17                  Document 01462, this is the '873 Patent,                       09:26:56  
18                  professional qualifications, and there is                       09:27:05  
19                  a similar one in the other one, which basically               09:27:07  
20                  says most of the things which I've done. It's a               09:27:11  
21                  high-level CV, if you want more details -- it's               09:27:15  
22                  relatively long -- you can have them. But we did               09:27:18  
23                  not include what is usually done like the most               09:27:22  
24                  important publications, patents filed and stuff               09:27:25  
25                  like that, because it didn't appear to be                       09:27:28



1	relevant.	09:27:29
2	Q. Okay. I just wanted to confirm	09:27:30
3	that your CV was not attached as an exhibit and	09:27:34
4	what we have for your professional qualifications	09:27:36
5	in each proceeding is what you've provided in	09:27:39
6	Section II of your declaration; is that fair?	09:27:43
7	A. Yeah. Is there anything more you	09:27:46
8	like to know?	09:27:48
9	Q. No, I just trying to make clear	09:27:49
10	for the record what we have and what we don't	09:27:51
11	have at this point.	09:27:54
12	So in 1998 you had already received your	09:27:58
13	PhD in nuclear physics from Frankfurt University;	09:28:03
14	is that correct?	09:28:03
15	A. Yes. That was in 1993. I	09:28:10
16	graduated in 1993 and right after that I moved to	09:28:13
17	Lawrence Berkeley National Laboratory as	09:28:18
18	a so-called post-doc. I got a Humboldt	09:28:21
19	Fellowship, which is an award which basically	09:28:24
20	says, "Here's a bunch of money, do what you want	09:28:27
21	with it", it's quite nice. And although I have	09:28:29
22	a PhD in nuclear physics, I have the Humboldt	09:28:35
23	Fellowship in computer science, which is	09:28:40
24	untypical. I had a dual interest all my life and	09:28:43
25	my thesis is also -- it is nuclear physics, but	09:28:48

for it to be done it needed a quite big and  
distributed computer to be built and it was  
built, it worked, and with that working computer,  
the data was recorded and that data was then  
analyzed and for the analyzed data I got the  
physics degree. And I did a Rigorosum, which  
means there were three exams, one hour each,  
theoretical physics, experimental physics and  
computer science, which all had to be passed.

Q. Much of that answer is helpful but 09:29:37

I was just trying to get to a simple point. So, 09:29:39

by 1998, you had your PhD in nuclear physics from 09:29:42

Frankfurt University which you'd received in 09:29:46

1993; is that correct? 09:29:49

A. That is correct. 09:29:50

Q. And nuclear physics is the study of what exactly, at a very high level?

A. This kind of instruction is not  
ease. But Goethe used to say to understand what  
keeps things together at its most fundamental  
level. So nuclear physics tries to understand  
the fundamental forces of nature of which there  
are four but normal people only experience two,  
gravitation and electric force, try to understand  
what happens inside a nucleus. In our case we

1        tried to understand what happens at the Big Bang        09:30:40  
2        and why do we exist, rather fundamental        09:30:42  
3        questions. The principle behind that is all        09:30:46  
4        these experiments are rather large systems, we're        09:30:51  
5        talking at that time already millions of sensors        09:30:57  
6        read out at megahertz rate and that means no        09:31:02  
7        ordinary storage media could take such data and        09:31:07  
8        that requires a large amount of computer        09:31:11  
9        infrastructure to be in place so absorb that data        09:31:14  
10       and analyze that data. And that is one of the        09:31:18  
11       reasons why I chose that field because I had        09:31:22  
12       an area which really, really required the most        09:31:24  
13       cutting-edge computer infrastructure, computer        09:31:27  
14       architectures to do the job. Nothing could be        09:31:32  
15       purchased off the shelf. Sloppy spoken, it's        09:31:34  
16       a nice playground for somebody who's really        09:31:41  
17       interested in computer science.        09:31:44  
18                My reason for answering your other        09:31:46  
19       question in a longer form was since you're        09:31:50  
20       emphasizing the PhD in nuclear physics, it might        09:31:53  
21       seem that I'm not an expert in computer science        09:31:56  
22       and this is why I tried to make that clear. And,        09:31:58  
23       as you see, although I have a PhD in nuclear        09:32:01  
24       physics, the next thing that happened was I was        09:32:04  
25       offered a chair in computer science, which is not        09:32:06

1	very usual.	09:32:10
2	Q. Okay, just to confirm, you do not	09:32:12
3	have a degree in computer science, correct? Your	09:32:15
4	degree is in nuclear physics even though you've	09:32:17
5	studied computer science?	09:32:21
6	A. I'm full Professor, endowed full	09:32:22
7	Professor in computer science, so ...	09:32:25
8	Q. But your degree is not in computer	09:32:27
9	science; is that right?	09:32:30
10	A. The PhD degree, yes.	09:32:31
11	Q. Well your undergraduate degrees	09:32:32
12	were not in computer science either were they?	09:32:35
13	A. The undergraduate degree is	09:32:39
14	physics, too. It's solid state physics, it's	09:32:39
15	about scanning tunneling microscopy, but it may	09:32:42
16	be surprising to you the scanning tunneling	09:32:48
17	microscope needed a computer to record the data	09:32:52
18	and an image analysis system to recalculate the	09:32:52
19	highly noisy signals which were recorded and I	09:32:56
20	built that system. So, again, I coupled computer	09:33:00
21	engineering/computer science with the	09:33:03
22	requirements in physics. It is always nicer to	09:33:06
23	build something which somebody needs than like	09:33:11
24	often happens some theoretical work is being done	09:33:16
25	but nobody has a real application for using it.	09:33:19

1 Relevance. 09:33:24

2 Q. Okay. But you mentioned computer 09:33:25

3 engineering, also you did not get a degree in 09:33:28

4 computer engineering what you're saying is you 09:33:35

5 took courses and studied that as part of the work 09:33:36

6 that you were doing in the physics field, 09:33:39

7 correct? 09:33:42

8 A. Yes, most of it is self-trained. 09:33:43

9 Q. Good. So then in paragraph 15 -- 09:33:45

10 and most of my questions are based on the '814 09:33:52

11 declaration, so the paragraph numbers might get 09:33:58

12 off if we use something else -- so the '814 09:34:00

13 declaration, paragraph 15, you offer your view of 09:34:03

14 what a person of skill in the art is for that 09:34:11

15 patent. Do you see that? 09:34:13

16 A. I pulled it up, yes. 09:34:15

17 Q. And a concept of a person of skill 09:34:15

18 in the art is based on your understanding 09:34:17

19 provided by counsel about what that means in the 09:34:21

20 patent law; is that correct. In paragraph 13, 09:34:24

21 for example, you explain what you understand a 09:34:28

22 person of skill in the art to be? 09:34:32

23 A. Let me look at it real quickly. 09:34:35

24 Q. Sure. And to be fair, 09:34:37

25 paragraph 14 also then explains what you 09:34:48

1 understand to be the appropriate level of the 09:34:50  
2 skill in the art, so I don't want to leave that 09:34:53  
3 one out. So it's 13, 14 and 15 sort of together. 09:34:55  
4 A. Yes. Bachelor's degree, with 09:34:58  
5 a bit of focus on computer architecture, yes. 09:35:01  
6 Q. And why did you choose bachelor's 09:35:06  
7 degree in computer science for the '814 Patent as 09:35:12  
8 opposed to other fields like physics or computer 09:35:16  
9 engineering? 09:35:19  
10 A. Kind of obvious. This patent 09:35:21  
11 family relates to computer architecture. 09:35:24  
12 Although I should say it relates to parallel 09:35:27  
13 computer architecture and my understanding is, 09:35:30  
14 and that was confirmed by Cooley and I also 09:35:33  
15 believe I have read that in the declaration by 09:35:36  
16 Young, that this is the kind of level which is 09:35:39  
17 typically being used. So, you know, it can't be 09:35:42  
18 too high a level. It has to be an ordinary skill 09:35:46  
19 in the art type thing and that is what I 09:35:53  
20 understand has been considered as the typical 09:35:56  
21 level. 09:35:59  
22 Q. Okay. It says in the middle, the 09:36:00  
23 person would hold a bachelor's degree or the 09:36:06  
24 equivalent in computer science or related 09:36:09  
25 academic field. What's your understanding of 09:36:13

what "related academic field" is?

A. This area, particularly when it is about computer architecture, has quite a few ties to engineering and computer engineering and you see that in particular since many of the schools in the U.S. even call themselves CSE/EE, Berkeley is an example, computer science/computer engineering. So that would be one example for a related field. But the fundamental knowledge which is required has a very -- has a strong element of computer science, right? I mean you have to understand how a computer works, how the different bits and pieces interrelate to each other, what are the appropriate standards in there being used, what are the principles to be used for what works, what doesn't work. And this is usually -- this is taught in computer science. If it then goes into how does it work in detail, how can it work, fast signals, slow signals, these kind of things, then engineering comes more and more into play.

Q. And what did you mean by "modular computing systems" in that definition?

A. Let me just check where is it?

Q. Two lines down where we were

EMC v. ACC

1	looking:	09:37:52
2	"... and three to four years of	09:37:53
3	additional experience in the field of modular	09:37:57
4	computer systems ..."	09:38:03
5	A. Yes, I see. Many of the	09:38:05
6	references which are being discussed here include	09:38:11
7	systems which consist of different subfunctions,	09:38:16
8	subsystems. Later they are being called or have	09:38:22
9	been called nodes. So one computer, another	09:38:27
10	computer, a network in between maybe a mass	09:38:30
11	storage system somewhere elsewhere. In	09:38:34
12	particular ...	09:38:34
13	(The court reporter sought	09:38:34
14	clarification.)	09:38:34
15	THE WITNESS: Mass storage system.	09:38:34
16	And their interconnect matrix allows	09:38:52
17	them to be combined in many different ways, and	09:38:56
18	that means you have a modular system allowing	09:38:58
19	different combinations of things together. And	09:39:02
20	this is relatively different as compared to	09:39:05
21	monolithic systems where, for instance, one	09:39:11
22	example could be the Blue Gene family of	09:39:15
23	computers which basically come as one big system	09:39:24
24	where if you look carefully you still find the	09:39:27
25	same building blocks, but they are all engineered	09:39:29



1 together as one thing and there is no 09:39:34  
2 interchangeability except you buy more nodes from 09:39:36  
3 the very same thing from the same vendor. 09:39:40  
4 BY MR. BUROKER: 09:39:42  
5 Q. Okay. Is it correct to say that 09:39:42  
6 by 1998 there were a variety of modular computing 09:39:45  
7 systems, computer architectures and computer 09:39:51  
8 communication protocols that were known to the 09:39:55  
9 person of skill in the art? 09:39:56  
10 MR. DAVIS: Objection; form. 09:40:00  
11 THE WITNESS: In order to give a very 09:40:05  
12 correct answer, the term "known" would have to be 09:40:16  
13 differentiated. Known in the sense of aware of 09:40:20  
14 existing certainly, yes. Known in the sense of 09:40:25  
15 being an in-depth expert is a different thing. 09:40:28  
16 This is why I hesitated to respond too quickly. 09:40:32  
17 Although we say here bachelor in computer 09:40:38  
18 science, the normal -- and I reviewed quite a few 09:40:44  
19 of the curriculum and I'm teaching this since 09:40:48  
20 1998 in fact, in regular classes -- bachelor of 09:40:52  
21 computer science usually includes quite a bit of 09:41:01  
22 mathematics, learning to start programming. One 09:41:04  
23 has to understand where they come from, right, 09:41:07  
24 they come from high school and usually they have 09:41:09  
25 no knowledge, no concept of real programming, 09:41:11

1           except if you have a few geeks who did this by           09:41:15  
2           themselves, like I did for example. But they           09:41:17  
3           have to learn all of that, and then they learn           09:41:19  
4           computer architecture but only computer           09:41:23  
5           architecture in the sense of the single computer           09:41:25  
6           with -- like one system. The entire context of           09:41:30  
7           parallel systems with all the additional           09:41:36  
8           complications which come in -- and I'm sure we           09:41:39  
9           will get to that point later -- are not typically           09:41:42  
10          part of the generic computer science curriculum.           09:41:46  
11          So if you say "are known" the answer would be           09:41:52  
12          they certainly knew it existed and they certainly           09:41:55  
13          may have known the relevant particular buzzwords,           09:41:59  
14          but the in-depth knowledge to know how a system           09:42:03  
15          really works, to put such a system together,           09:42:06  
16          debug it, find error, I would say likely not.           09:42:09  
17          BY MR. BUROKER:           09:42:13  
18                   Q.    Well, this person that we've           09:42:13  
19          defined isn't just a beginning computer science           09:42:14  
20          student, it's a person who's already received           09:42:21  
21          their degree and worked for three to four years           09:42:23  
22          in the field. So would that person have more           09:42:25  
23          in-depth knowledge of modular computer systems,           09:42:27  
24          computer architecture and communication           09:42:32  
25          protocols?           09:42:33

1	MR. DAVIS: Objection; form.	09:42:33
2	THE WITNESS: Whether generic	09:42:38
3	experience working in the field at this abstract	09:42:40
4	level, the answer would be no. There would have	09:42:45
5	been some additional teaching and specialization	09:42:47
6	have to happen after the degree as a bachelor.	09:42:51
7	And maybe I should clarify that. I	09:43:01
8	mean I do teach a class about parallel computer	09:43:05
9	architecture since many years now, and this is	09:43:08
10	going a full semester, it's a full big class with	09:43:10
11	everything, and it is far not enough to get the	09:43:14
12	relevant knowledge into the heads of the students	09:43:21
13	and this is master level.	09:43:23
14	BY MR. BUROKER:	09:43:23
15	Q. In what year did you begin working	09:43:30
16	on modular computer systems, computer	09:43:33
17	architecture and computer communication	09:43:39
18	protocols? That was well before '93 I assume.	09:43:44
19	A. It's not possible to give an exact	09:43:47
20	and good date but in order to give you an answer	09:43:55
21	maybe I just tell you what I did and then you see	09:44:00
22	how things evolved. At the age of --	09:44:02
23	Q. Well, I'm asking for a very	09:44:06
24	specific -- I know that you like to answer	09:44:07
25	questions in your way and you're welcome to, I'm	09:44:10

1	asking for a year. So, if you can answer that	09:44:12
2	question then I'm happy to have you give	09:44:15
3	an explanation.	09:44:18
4	A. My first modular and own computer	09:44:18
5	I got and improved and built was at the age of	09:44:24
6	probably 17. Now, I have to calculate the year.	09:44:28
7	You know my age so, I'm 52 years old, so at the	09:44:34
8	age of 16, this is 36 years ago, right? 2015	09:44:41
9	minus 36 we're talking something like 1980. That	09:44:53
10	was a Z80 computer, 8-bit machine. Then I later	09:44:57
11	started connecting multiple of those, building	09:45:02
12	larger systems all by myself. I financed my	09:45:06
13	studies by building computers for industry and	09:45:09
14	they paid me for it, which shows this is going	09:45:12
15	back quite some way. I already outlined doing my	09:45:17
16	diploma pieces I built such a system from	09:45:23
17	scratch. In the thesis it was a larger system	09:45:26
18	and, in fact, it is the first bigger highly	09:45:28
19	modular interconnected system I believe that was	09:45:33
20	ever built, and this is timescale '93. So it's	09:45:36
21	going back a long time.	09:45:40
22	Q. So, would you consider yourself to	09:45:44
23	be an expert in the field of modular computing	09:45:46
24	systems, computer architecture and computer	09:45:50
25	communication protocols?	09:45:53

1 A. Yes. 09:45:54

2 Q. Okay. So when you're doing your 09:45:54

3 analysis in connection with this case and 09:45:57

4 providing this declaration, were you looking at 09:45:59

5 things from your perspective as an expert, or 09:46:03

6 from the perspective of a person of skill in it 09:46:07

7 the art as you've defined it, which is someone of 09:46:08

8 less experience than you? 09:46:13

9 A. Had to be, yes. And I believe I 09:46:16

10 set this forth, I mean the definition of a person 09:46:18

11 of ordinary skill in the art is set forth in the 09:46:21

12 declaration, and my understanding is this is the 09:46:24

13 perspective which had to be used. 09:46:29

14 Q. Right. So you used the 09:46:34

15 person-of-skill-in-the-art perspective as opposed 09:46:36

16 to your own, correct? 09:46:38

17 A. Does it have to be opposed to? 09:46:42

18 Q. Well, in analyzing the opinions, 09:46:46

19 whether something is obvious or anticipated or 09:46:50

20 known, did you do that from the perspective of 09:46:53

21 a person of skill in the art or from an expert's 09:46:56

22 perspective? 09:47:01

23 A. Now I understand the subject 09:47:07

24 material of course as an expert. The conclusions 09:47:08

25 drawn in here I believe are valid in both cases, 09:47:12

1 and we can go into details, but in principle they 09:47:17  
2 would have to be -- would be taken in the view of 09:47:22  
3 the person of ordinary skill in the art because 09:47:25  
4 this is how it works. 09:47:28

5 Q. So what I've handed you is what we 09:48:58  
6 call the Bogaerts reference which is Exhibit 1011 09:49:01  
7 in the 1469 IPR proceeding which is the one 09:49:08  
8 related to the '814 Patent. Make sure I have the 09:49:14  
9 numbers right, there are a lot of complicated 09:49:25  
10 numbers here. 09:49:27

11 So, are you familiar with this document? 09:49:28

12 A. Yes, I am. 09:49:30

13 Q. Okay. And, in fact, if you look 09:49:31  
14 at -- I'm going to have you do two things at once 09:49:34  
15 -- paragraph 170 of the '814 declaration which 09:49:40  
16 you were just looking at, the first sentence 09:49:44  
17 says: 09:49:48

18 "I am an author of the Bogaerts 09:49:49  
19 reference." 09:49:52

20 Is that correct? 09:49:52

21 A. Yes, as you can see on the front 09:49:53  
22 page. 09:49:55

23 Q. In other places I think you also 09:49:55  
24 say you're a co-author but you basically mean 09:49:57  
25 you're one of the authors, correct? 09:50:00

1                   A.    Yeah.  There is only a very minor                   09:50:03  
2                   distinction between the two and that is more                   09:50:09  
3                   a game played in research of who is called the                   09:50:14  
4                   primary or first author and who is called the                   09:50:17  
5                   last author and that even is different in the                   09:50:19  
6                   different fields.  So in medicine the last author                   09:50:21  
7                   is always the group leader.  Here this is                   09:50:24  
8                   a status report and basically there is just                   09:50:29  
9                   basically a list of those who have contributed.                   09:50:32  
10                  Q.    That's what I wanted to get to.                   09:50:38  
11                  Was there a primary author of this status report?                   09:50:40  
12                  A.    The way it worked was this is                   09:50:46  
13                  a status report of a working group, this RD24,                   09:50:52  
14                  which was chaired by Hans Müller and he did the                   09:50:55  
15                  writing most of the time, putting things together                   09:50:57  
16                  where everybody delivered bits and pieces.  So I                   09:51:01  
17                  certainly delivered also some chapters here, in                   09:51:05  
18                  particular about the PCI-SCI bridge.  Then it was                   09:51:07  
19                  circulated and at some point everybody said it's                   09:51:11  
20                  okay to be our status report at this particular                   09:51:14  
21                  time.                   09:51:19  
22                  Q.    Did everyone on the front page of                   09:51:23  
23                  this document contribute to the text of the                   09:51:25  
24                  status report?                   09:51:30  
25                  A.    I certainly did.  I can't tell for                   09:51:33

1	everyone in particular because, you know, I	09:51:35
2	haven't checked every email which went possibly	09:51:38
3	directly to Hans Müller, but certainly everybody	09:51:42
4	was involved here. I know most of the people	09:51:46
5	personally, actually I know all of them pretty	09:51:50
6	much, although many have disappeared from this	09:51:54
7	research field.	09:51:59
8	Q. So how was this document compiled?	09:51:59
9	You mentioned emails. How did it get to be in	09:52:01
10	the form that it's in?	09:52:05
11	A. I remember Hans Müller likes to	09:52:10
12	write with FrameMaker, which is a text writing	09:52:13
13	tool, I'm not sure it exists anymore, quite	09:52:17
14	a nice thing. I believe at that time I had	09:52:21
15	FrameMaker, too. And the important thing was are	09:52:26
16	the results we can present which are convincing,	09:52:33
17	showing that there was great progress? These	09:52:36
18	results were pulled together, sent forth and	09:52:40
19	back. I mean you have to understand I was in	09:52:45
20	Berkeley, California, this is nine hours' time	09:52:48
21	difference. I spent frequent time at CERN at	09:52:49
22	that time going constantly forth and back.	09:52:52
23	Andreas Bogaerts is CERN.	09:52:57
24	We have the University of Oslo, Bernard	09:53:00
25	Skaaai he's retired now. Oslo is a two- or	09:53:03



1 three-hour flight from Geneva, so for them it was 09:53:10  
2 also quite an effort to get there, they did a lot 09:53:13  
3 of their work at Oslo. 09:53:15

4 Spain. We had a student who worked at 09:53:18  
5 CERN but the group leader was in Spain so, again, 09:53:25  
6 requirement for interchange. 09:53:29

7 Kare Løchsen and Hugo Kohmann is 09:53:31  
8 Dolphin, again same thing. Dolphin's role was 09:53:34  
9 the supplier of many of the chips which are being 09:53:38  
10 discussed in here and being evaluated, tested and 09:53:42  
11 so forth, being part of a ... 09:53:47

12 Digital Equipment is head of joint 09:53:50  
13 project with CERN and I believe this is the 09:53:53  
14 Geneva branch of Digital so he was close. He 09:53:55  
15 could have had direct interactions with Hans 09:53:58  
16 Müller. 09:54:02

17 Q. Right, so the question that I 09:54:02  
18 asked was more, you know, was there a person who 09:54:04  
19 typed in all the text or did each of the various 09:54:08  
20 people send sections to be posted into the 09:54:10  
21 document? How was it compiled? 09:54:13

22 A. Both. I mean this is almost 09:54:16  
23 20 years ago. 09:54:20

24 Q. Right. 09:54:21

25 A. But this was nothing out of the 09:54:21

1 ordinary, and the normal way it goes is people 09:54:24  
2 send in stuff, text blocks, figures, diagrams. 09:54:27  
3 I'm quite sure this diagram is from myself. The 09:54:32  
4 big picture I believe Hans Müller did, although 09:54:35  
5 the board I believe is the one I supplied. You 09:54:38  
6 know, these kind of details. And then Hans 09:54:42  
7 Müller put it together in a big document, then we 09:54:46  
8 went over it, and at some point it was the final 09:54:48  
9 version, a postscript file was generated and this 09:54:50  
10 is what was submitted. 09:54:54  
11 Q. So based on your recollection, 09:54:55  
12 which portions of this document did you write or 09:55:00  
13 which figures did you contribute? 09:55:03  
14 MR. DAVIS: Objection; form. 09:55:07  
15 THE WITNESS: I mean, this is really a 09:55:14  
16 long time ago. My focus of work at that time was 09:55:17  
17 the PCI-SCI adapter, which you may have noticed 09:55:25  
18 is a core device in this whole document, because 09:55:29  
19 many of the system architectures which are 09:55:32  
20 sketched and outlined here need this as 09:55:36  
21 a fundamental building block. And I was 09:55:39  
22 basically working with very a significant 09:55:43  
23 fraction of my time on this device because I 09:55:47  
24 needed it for myself in Berkeley. We were trying 09:55:49  
25 to build a very large data acquisition system and 09:55:52

1 we needed the PCI-SCI device for that. So that 09:55:55  
2 means Section 3.1 is a very strong candidate for 09:55:58  
3 me being involved. You also see that there is a 09:56:06  
4 small -- 3.2 says, "Collaboration ... with the 09:56:11  
5 STAR Trigger group", which is me basically. STAR 09:56:15  
6 is the name of an experiment being prepared at 09:56:21  
7 that time at Brookhaven National Laboratory. 09:56:23  
8 STAR stands for solenoidal tracker at RHIC. 09:56:28  
9 S-o-l-e-n-o-i-d-a-l tracker at RHIC. A solenoid 09:56:34  
10 is a particular kind of a magnet. 09:56:43  
11 BY MR. BUROKER: 09:56:50  
12 Q. So, at least -- and there may be 09:56:50  
13 others -- but you recall at least contributing to 09:56:52  
14 3.1 and 3.2? 09:56:58  
15 A. These would be the core ones. I 09:56:59  
16 have been involved in other stuff. I have 09:57:01  
17 certainly read it and looked at it, but I can't 09:57:03  
18 remember the details after such a long time. 09:57:11  
19 Q. This document talks about two 09:57:15  
20 different PCI-SCI adapters, correct? There's the 09:57:22  
21 CERN one which you mentioned and then there's 09:57:26  
22 also one by Dolphin; is that right? 09:57:28  
23 A. Correct. 09:57:31  
24 Q. Did you work on the Dolphin 09:57:31  
25 PCI-SCI adapter? 09:57:33

1                   A.    No.  I believe at that time it                   09:57:35  
2                   didn't really fully exist yet.  Let me just               09:57:39  
3                   check.  Do you remember which section it is being       09:57:45  
4                   discussed?  Here we are.                               09:57:49  
5                   Q.    Where are you looking?                           09:57:59  
6                   A.    Section 3.3, it says:                            09:58:00  
7                   "RD24 has acquired Dolphin bridges ..."  
8                   Not sure it existed yet or what state               09:58:23  
9                   it was at that time.                               09:58:25  
10                  Q.    Okay.  How did you come to be               09:58:31  
11                  involved in this RD24 project?                       09:58:47  
12                  A.    I need to outline what this is all               09:58:55  
13                  about in order to make this clear.                    09:58:58  
14                  "RD" stands for "research and                        09:59:00  
15                  development" and 24 simply means it's the 24th       09:59:02  
16                  research and development project at CERN.  This       09:59:06  
17                  nuclear physics or high-energy physics field has       09:59:11  
18                  a particular problem.  It takes some often            09:59:15  
19                  25 years to prepare an experiment, this long, and       09:59:21  
20                  at the LHC we're talking about that kind of time.       09:59:25  
21                  The LHC was first started to be planned around        09:59:30  
22                  1980, the first proposals, the first documents,        09:59:33  
23                  how it was going to be were written at that time,       09:59:36  
24                  and it went in operation 2007/8/9, I can't            09:59:39  
25                  remember exactly.  2005 it was scheduled but        09:59:47

1           there were delays. And when it was started, 09:59:49  
2           there were many areas where the proposal 09:59:54  
3           basically said today no known technologies exist 09:59:58  
4           to solve the problem, in particular in computer 10:00:01  
5           engineering areas. Everybody likes to refer to 10:00:05  
6           Moore's law like things will get faster and 10:00:08  
7           cheaper but, of course, over a period of 25 years 10:00:13  
8           we're talking at the least three, four computer 10:00:15  
9           generations, it is rather difficult to make 10:00:19  
10          a clear, dependable proposal that how it would be 10:00:21  
11          to build such a system and how much it would cost 10:00:24  
12          because when you submit a proposal you have to 10:00:27  
13          have a cost figure. So in order to avoid either 10:00:29  
14          using hopelessly dated technology when the 10:00:34  
15          experiment went online -- and, I mean, the LHC 10:00:37  
16          project all together is a \$6 billion project, 10:00:40  
17          it's not a cheap thing -- there had to be 10:00:43  
18          research and development done in order to 10:00:47  
19          minimize the risk of uncertainty which technology 10:00:53  
20          to use and that the technology would still be 10:00:55  
21          available when the experiment and the accelerator 10:00:57  
22          would go online. Lots of technologies come and 10:01:01  
23          go. And RD24 is the research and development 10:01:03  
24          project which was set forth to investigate and 10:01:08  
25          develop a modular, highly scaleable computer 10:01:11

1 architecture, scaling to literally thousands of 10:01:14  
2 computer nodes. The CERN experiments today have 10:01:17  
3 thousands of computers connected together to 10:01:20  
4 process the data of each and every experiment 10:01:23  
5 there, huge effort, it would fill the entire 10:01:25  
6 building, yeah? And there was no network 10:01:30  
7 existing which would solve these problems, so 10:01:34  
8 RD24 decided to focus on SCI -- the scalable 10:01:40  
9 coherent interface -- as a very good and strong 10:01:44  
10 candidate for solving these problems. So this is 10:01:46  
11 the context. 10:01:49  
12 I was working at that time in Berkeley, 10:01:50  
13 for the STAR experiment at the Relativistic Heavy 10:01:53  
14 Ion Collider in Brookhaven. 10:02:06  
15 (The court reporter sought 10:02:06  
16 clarification.) 10:02:06  
17 THE WITNESS: Relativistic Heavy Iron 10:02:08  
18 Collider. Relativistic stands for that the 10:02:10  
19 particles basically have speed of light. And 10:02:11  
20 same problem, long-term development, yet 10:02:15  
21 requirement to make clear proposals how one could 10:02:21  
22 actually handle this kind of amount of data. 10:02:25  
23 When I started in Berkeley, I was asked 10:02:28  
24 to do a technology evaluation to look at ATM, at 10:02:32  
25 fibre channel -- f-i-b-r-e channel the English 10:02:38



1 document -- may have said, "Hey, do you know 10:04:11  
2 there is a group, wouldn't it make sense for you 10:04:13  
3 to be involved?" It may also be that I just -- 10:04:16  
4 that we already had something to do earlier. 10:04:25  
5 I would really have to check my records more than 10:04:28  
6 20 years ago, I'm not sure I still have all the 10:04:30  
7 emails. But in this area, this is a highly 10:04:32  
8 specialized very high-tech, cutting-edge field, 10:04:38  
9 the community is small and they are usually -- 10:04:45  
10 and we had, too, certain kinds of conferences, 10:04:51  
11 working meetings and so forth, so it was almost 10:04:53  
12 clear that we had to bump into each other and 10:04:58  
13 then decide that it makes sense to work together. 10:05:00  
14 Q. So you mentioned that you were 10:05:05  
15 helping to develop what you mentioned in the 10:05:07  
16 document as the CERN PCI-SCI adapters. Did any 10:05:10  
17 of the other people on this document help you 10:05:14  
18 with that? 10:05:16  
19 A. The part of this document I don't 10:05:23  
20 like is the CERN PCI-SCI adapter because the 10:05:26  
21 majority of the work I have done myself. But, 10:05:30  
22 yes, there has been cooperation and I remember I 10:05:33  
23 spent something like close to two months at CERN, 10:05:37  
24 when we decided, "We are rather close, let's do 10:05:41  
25 some real push together", but I can't tell 10:05:46



1           whether this was before or after the submission           10:05:49  
2           of this report because if you know -- you may           10:05:51  
3           have noticed but this report states rather           10:05:56  
4           clearly that this device was not finished at all           10:05:59  
5           at that time, and we can get to the details. I           10:06:02  
6           remember working with Bin Wu -- B. Wu -- he's           10:06:05  
7           a Chinese person. At that time I believe he was           10:06:11  
8           post-doc. I believe also one of Valencia           10:06:13  
9           students who were there at the time, I remember           10:06:21  
10          we were a group of three people basically working           10:06:26  
11          together, but since the other names I don't think           10:06:31  
12          were directly involved in this particular case,           10:06:38  
13          and we're talking real hard-core engineering           10:06:40  
14          development of gates, writing the HDL codes,           10:06:44  
15          synthesizing, time enclosure kind of thing.           10:06:52  
16                   Q. Did you all have -- strike that.           10:07:03  
17                   As part of the RD24 project were there           10:07:04  
18          regular conference calls or meetings?           10:07:07  
19                   A. Yes.           10:07:10  
20                   Q. Did you physically inspect the           10:07:10  
21          computer systems that other people in the project           10:07:16  
22          were working on?           10:07:19  
23                   A. Yes, many of them have been set up           10:07:21  
24          also for demonstration at CERN. This is one of           10:07:26  
25          those sad stories in research, the big labs have           10:07:31

1           the big money, the universities don't, so many of           10:07:35  
2           those things were really expensive. So CERN had           10:07:38  
3           the money to buy them and then all the           10:07:41  
4           universities would basically go to CERN in order           10:07:45  
5           to be able to play with them. I used, for           10:07:48  
6           example, also the simulation framework developed           10:07:53  
7           in Oslo to evaluate and extrapolate performance.           10:07:57  
8           I believe the VME system was at CERN.           10:08:03  
9                   Q.    When you say the "VME system",           10:08:08  
10          which one are you referring to? The one in           10:08:11  
11          Figure 15 or some other one?           10:08:14  
12                   A.    The PCI-SCI card which I focused           10:08:23  
13          on is -- if you look at Figure 4, you will see           10:08:26  
14          this device which has a rectangular shape. And           10:08:31  
15          it's called PMC 75 by 150 millimeters. "PMC"           10:08:38  
16          stands for "PCI mezzanine card". It is not the           10:08:44  
17          PCI form factor as set forth in the PCI           10:08:47  
18          specification, PCI 2.1, which was the relevant           10:08:51  
19          one at that time. There is an add-on spec which           10:08:55  
20          says use everything as written in the PCI 2.1           10:09:00  
21          spec except for the mechanical form factor, use           10:09:03  
22          that form factor and these white connectors to           10:09:06  
23          your right, such that you can plug them into           10:09:09  
24          a VME board. Most VME processors use PCI also,           10:09:12  
25          but in a different form factor because they           10:09:17

1           wouldn't otherwise fit into these crates. And so 10:09:20  
2           then, for example -- now I'm trying to find this 10:09:24  
3           picture, it's the VME module with a PMC on it. 10:09:29  
4           And these evaluations were done. Yeah, for 10:09:36  
5           example, Figure 19 you see the VME board and the 10:09:39  
6           PMC card. 10:09:40  
7                   Q. I see. And you physically saw 10:09:50  
8           this? What's shown in Figure 19, is a depiction 10:09:58  
9           of something that was built and that you saw at 10:10:02  
10          CERN? 10:10:05  
11                   A. In one or a different 10:10:07  
12          incarnations. I mean this is a lab, right? 10:10:09  
13          Things have been put together, taken apart, 10:10:12  
14          reconnected, yeah, but this system or a variant 10:10:14  
15          of that I've certainly seen. 10:10:19  
16                   Q. And as part of this project, how 10:10:24  
17          frequently did you say you travelled to CERN? 10:10:27  
18                   A. I can't tell exactly, once or 10:10:42  
19          twice a year, this kind of thing. You have to 10:10:44  
20          remember I was in the U.S. first as a foreigner, 10:10:47  
21          I came in on a J-1 visa. Then I changed to 10:10:51  
22          an H-1, and then I got the green card based on 10:10:55  
23          the national interest waiver. Before I had the 10:10:58  
24          green card, leaving the U.S. was quite a painful 10:11:02  
25          thing. So this was not just something you just 10:11:03

1           decide and do the next day. But even with this           10:11:06  
2           corollary I believe I certainly did one or two           10:11:16  
3           trips a year to keep the work going, there is           10:11:19  
4           only so much you can do over email and video           10:11:25  
5           conferences.           10:11:29  
6                   Q. In terms of this particular status           10:11:29  
7           report, that's Exhibit 1011, do you recall seeing           10:11:31  
8           a draft of it before it was submitted?           10:11:38  
9                   A. I assume so. I don't explicitly           10:11:42  
10          recall seeing a draft, this is too long a time           10:11:45  
11          ago, but the way this was usually done -- in           10:11:48  
12          fact, in the research field submitting a document           10:11:53  
13          with an author on it without the author seeing it           10:11:58  
14          beforehand would be an outrage, you can't do that           10:12:01  
15          really. But if you ask me, "Do you remember when           10:12:04  
16          you saw this?" this I cannot tell, this is too           10:12:07  
17          long ago.           10:12:10  
18                   Q. So standard protocol because your           10:12:10  
19          name is on it is that everybody on this           10:12:12  
20          particular document would have been provided           10:12:15  
21          a copy before it was submitted, correct?           10:12:16  
22                   A. Good conduct would be and           10:12:19  
23          everybody says, "Yes and I agree with the content           10:12:21  
24          in there."           10:12:22  
25                   Q. You say in your declaration that           10:12:24

1           it was submitted to somebody. Who was it           10:12:26  
2           submitted to that you recall?           10:12:30  
3                   A. LHCC Committee. I guess I should           10:12:34  
4           do some explanation here --           10:12:42  
5                   Q. Sorry, I apologize but --           10:12:42  
6                   A. LHCC.           10:12:42  
7                   Q. Okay, so there's also an LHC, what           10:12:42  
8           is the difference? What does "LHCC" stand for?           10:12:47  
9           Is that the LHC Committee?           10:12:49  
10                   A. More or less, yes, but I wish to           10:12:52  
11           give you a few more details because otherwise           10:12:58  
12           this is too broad a term and it doesn't come           10:13:00  
13           clear what this is all about.           10:13:02  
14                   Q. Okay, let me just for clarity ask           10:13:03  
15           you what does "LHCC" stand for then?           10:13:06  
16                   A. This a review committee which was           10:13:08  
17           put into place to monitor and evaluate the           10:13:12  
18           progress of all related research and development           10:13:17  
19           groups of the LHC project and all other projects           10:13:21  
20           all together. So, I have reported to the LHCC           10:13:26  
21           every three months since 1998 for stuff right           10:13:30  
22           outside RD24.           10:13:35  
23                   This is a very, very tough review           10:13:38  
24           process. So you submit a document, you then           10:13:43  
25           basically report orally. The committee then           10:13:46

1 writes a report and the report is then reported 10:13:50  
2 to the CERN Director and only the committee can 10:13:54  
3 defend your project, so you have to teach the 10:13:59  
4 reviewers that they defend your project in front 10:14:02  
5 of the CERN Director, Scientific Director. 10:14:05  
6           So the idea behind it is that you have 10:14:08  
7 to be -- it's not just, you know, you thumb over 10:14:10  
8 some documents and say, "Well it's cool, it's all 10:14:13  
9 right", but a very stringent, very tough review 10:14:16  
10 process in order to make sure that this huge 10:14:20  
11 highly complex project has a chance of 10:14:23  
12 succeeding. 10:14:25  
13           All these processes were following a 10:14:27  
14 rather strict order and an internal rule set. 10:14:31  
15 The reviewers were usually set out to accompany 10:14:37  
16 a particular project for a longer period of time, 10:14:40  
17 we're talking several years, and if the reviewers 10:14:43  
18 would say, "This project is not performing" 10:14:49  
19 rather tough scrutiny would happen. I've seen it 10:14:53  
20 happening -- fortunately never in my own case -- 10:14:57  
21 that you get down to weekly and even daily 10:15:00  
22 reports when you're really starting to get into 10:15:04  
23 bad shape. 10:15:08  
24           The idea behind it is to have a complete 10:15:09  
25 view of this huge development -- the same was 10:15:11

1           done for the accelerator, for example -- to make           10:15:14  
2           sure that everything comes together in time.           10:15:16  
3                   Q.     So I understand it, there are           10:15:18  
4           a number of different projects that were related           10:15:21  
5           to the LHC and this RD24 was one of those           10:15:23  
6           projects, correct?           10:15:30  
7                   A.     Yes.           10:15:31  
8                   Q.     And so the status report was           10:15:31  
9           a report created by the RD24 working group that           10:15:33  
10          was submitted to the LHCC as part of some           10:15:38  
11          periodic review?           10:15:42  
12                  A.     Yeah.           10:15:43  
13                  Q.     Okay. Who is on the LHCC at that           10:15:44  
14          time? In general, what kinds of people?           10:15:47  
15                  A.     People my status.           10:15:52  
16                  Q.     Okay.           10:15:53  
17                  A.     Director of an institute, full           10:15:54  
18          professor, ten years' minimum experience in the           10:15:59  
19          field, highly outstanding scientific record,           10:16:01  
20          publication record. And, in fact, it was           10:16:08  
21          an issue over time -- because this is a huge           10:16:10  
22          amount of work for the reviewers, too -- to           10:16:12  
23          really find people at that level. We're talking           10:16:15  
24          around the globe, all time zones, they all had to           10:16:17  
25          travel to CERN, get together, do their work.           10:16:23

1           Such a review, the bigger ones which were           10:16:25  
2           quarterly, usually took a couple of days           10:16:29  
3           depending on the size of the project. Now, RD24           10:16:31  
4           would be considered a small project, right? If           10:16:34  
5           you take the ALICE experiment, the ALICE           10:16:37  
6           experiment had some 20 subprojects, where each           10:16:40  
7           one was at least as large as RD24 and they all           10:16:44  
8           were reviewed like that, you know.           10:16:47  
9                    Q.    So, how many people in this           10:16:49  
10          1996-1998 timeframe sat on the LHCC?           10:16:54  
11                    A.    I can't give you an exact number.           10:17:01  
12          We're talking a handful, three, four, five.           10:17:03  
13          Depending on the particular project being           10:17:07  
14          reviewed. In the case of ALICE the group was           10:17:11  
15          larger because the spread of different           10:17:16  
16          technologies was larger. Here this is -- in           10:17:18  
17          quotes -- only computer architecture, computer           10:17:24  
18          engineering. Normally you have detector physics           10:17:27  
19          on top of it, material science. Detectors are           10:17:31  
20          highly complex devices pushing the limits of           10:17:35  
21          material science, for example, so you have people           10:17:38  
22          understanding that also.           10:17:40  
23                    But the LHCC is a whole body all           10:17:42  
24          together, so it would all come together then and           10:17:45  
25          then be reported, all subprojects. It's a big           10:17:48



1 thing. 10:17:51

2 Q. So at the top of the document 10:17:52

3 there's a heading in the right and it says: 10:17:57

4 "CERN/LHCC" and then "LHCC 96-33". Do 10:18:01

5 you know what that means? 10:18:10

6 A. I would assume this is the year 10:18:13

7 and probably the 33rd kind of meeting of that. 10:18:15

8 The exact number scheme I don't know. It's 10:18:19

9 an internal LHCC coding so that they find their 10:18:24

10 reports. 10:18:27

11 Q. Okay, and then it says "LCB Status 10:18:27

12 Report". Do you know what "LCB" means? 10:18:32

13 A. I do, but now I don't remember the 10:18:37

14 exact acronym. It could be LHC Computing Board, 10:18:41

15 something like that. 10:18:49

16 Q. And the "2 October 1996", you 10:18:53

17 indicate in your declaration that you believe 10:18:58

18 that is the date that this status report was 10:19:00

19 submitted to the LHCC; is that correct? 10:19:02

20 A. Yeah. 10:19:05

21 Q. And what is the basis for -- do 10:19:05

22 you have any basis for that other than your 10:19:12

23 memory for saying that that's the date it was 10:19:15

24 submitted to the committee? 10:19:17

25 A. This is a status report of 10:19:20

1 a working group which is basically documenting 10:19:22  
2 a work in progress. Many things in here are 10:19:28  
3 outlined as options for the future or how one 10:19:33  
4 could do things, what are the things which are 10:19:36  
5 essential to be built, how far the process of 10:19:41  
6 building has come. And obviously that has to 10:19:43  
7 have a date as of when this status has been 10:19:46  
8 written and submitted because obviously if you 10:19:49  
9 report time in progress, the next day it's 10:19:52  
10 already invalid, strictly spoken, and this is the 10:19:54  
11 date when this was submitted. There is no other 10:19:57  
12 date on this document. 10:20:00  
13 Q. Right so -- 10:20:01  
14 A. I have one question or favor to 10:20:01  
15 ask. I would like to go to the bathroom. 10:20:05  
16 MR. BUROKER: Oh, yeah, I should have 10:20:08  
17 said at the beginning, any time you need to take 10:20:09  
18 a break, we can take a break. So let's go off 10:20:11  
19 the record and take a short break. 10:20:14  
20 (Brief recess 10:20 a.m. - 10:27 a.m.) 10:27:41  
21 BY MR. BUROKER: 10:27:45  
22 Q. Sir, looking at paragraph 170 of 10:27:48  
23 the declaration we were looking at before in the 10:27:53  
24 '814 proceeding, you state that the date on the 10:28:00  
25 front of the Bogart reference, which is 10:28:03

1 Exhibit 1011 we were looking at, has a date and 10:28:05  
2 that's the date submitted to the CERN LHCC 10:28:09  
3 Committee. That's your testimony, correct? 10:28:14  
4 A. Yeah. 10:28:15  
5 Q. And you don't cite anything to 10:28:16  
6 support that, that's just your testimony based on 10:28:19  
7 your memory of how the proceedings were, correct? 10:28:25  
8 MR. DAVIS: Objection; form. 10:28:31  
9 BY MR. BUROKER: 10:28:32  
10 Q. Right? Next to that sentence 10:28:33  
11 there's no citation to any other document or 10:28:34  
12 piece of evidence, just your memory, correct? 10:28:36  
13 A. Well, I mean if you write 10:28:39  
14 a document, a report of any sort, in particular 10:28:41  
15 a status report, it is completely invalid without 10:28:46  
16 a date. So this date has to be the date when 10:28:49  
17 this report was finalized as the status of the 10:28:59  
18 RD24 project at that time. If you would remove 10:29:04  
19 that date, or declare it to be something else, 10:29:12  
20 this status report would be meaningless. 10:29:15  
21 Q. Right. But you're trying -- 10:29:17  
22 strike that. 10:29:17  
23 You're saying also that that date 10:29:23  
24 represents the date submitted to committee and 10:29:25  
25 not the date of its public availability or 10:29:28

1 indexing by the library. And for that 10:29:31  
2 proposition you also do not cite anything, 10:29:36  
3 correct? 10:29:38  
4 MR. DAVIS: Objection; form. 10:29:39  
5 THE WITNESS: This is the date which 10:29:43  
6 defines the status of that report and this is the 10:29:51  
7 date when it was submitted -- this is the date 10:29:53  
8 when it was given to the LHCC, possibly one or 10:29:58  
9 two days later. Usually they were written up to 10:30:02  
10 the last minute, you know, all these reports are 10:30:04  
11 usually generated, everybody's late. And from 10:30:07  
12 this document, or anything I've seen so far, I 10:30:13  
13 have not seen any evidence that says that it was 10:30:19  
14 then publicly available, that's correct. 10:30:23  
15 BY MR. BUROKER: 10:30:25  
16 Q. All right. But you also don't 10:30:25  
17 know, and can't provide testimony, that it wasn't 10:30:28  
18 publicly available as of October 2, 1996, right? 10:30:32  
19 MR. DAVIS: Objection; form. 10:30:37  
20 THE WITNESS: I mean here I wish really 10:30:41  
21 to stick to what I say in my report. What do we 10:30:47  
22 have here? I'm saying I'm unaware of any day 10:30:52  
23 prior to the priority filing date of the '814 10:30:59  
24 Patent that the RD24 report was published, 10:31:03  
25 indexed or made available to the public, which 10:31:05

1           are the relevant things here. So this is what it           10:31:07  
2           is: I'm not aware. I'm not saying it was, I'm           10:31:13  
3           not saying it was not, I'm just not aware.           10:31:17  
4           BY MR. BUROKER:           10:31:20  
5                   Q.    Okay. In the previous sentence,           10:31:21  
6           you say -- strike that. Let me come back to           10:31:22  
7           that.           10:31:28  
8                   Then in paragraph 171 you make reference           10:31:29  
9           to:           10:31:37  
10                   "... bibliographic data on the CERN           10:31:43  
11           library server that lists the Bogaerts reference           10:31:46  
12           as 'submitted by October 2, 1996' ..."           10:31:50  
13                   And you say:           10:31:52  
14                   "[It] relates to the date the ...           10:31:52  
15           report was submitted to the ... committee; it           10:31:53  
16           does not relate to the day the RD24 report was           10:31:55  
17           available or indexed in the CERN library."           10:31:59  
18                   What's your basis for saying that?           10:32:02  
19                   A.    Is there any date? I can't see           10:32:05  
20           any date on the CERN library stamp. I mean this           10:32:08  
21           is an index basically uniquely identifying this           10:32:11  
22           document as part of the CERN library, it says           10:32:14  
23           nothing about its public availability. And one           10:32:17  
24           should make one thing perfectly clear here, even           10:32:21  
25           if a document is in the CERN library, it's far           10:32:24

1 from being publicly available. In order to get 10:32:26  
2 to the CERN library you have to cross the CERN 10:32:29  
3 entry, and the CERN entry you can only cross if 10:32:32  
4 you're a CERN member. The United States are not 10:32:34  
5 member state of CERN. So, for instance, nobody 10:32:38  
6 from the U.S. could easily be entering CERN at 10:32:41  
7 all. You first have to become at least a guest 10:32:45  
8 of CERN, which means you have to have a project 10:32:49  
9 at CERN or with high relevance to CERN, like I 10:32:52  
10 did, but I had my ID already beforehand, and then 10:32:56  
11 you can go to the CERN library on site of CERN. 10:32:59  
12 Be aware, CERN is an international organization; 10:33:03  
13 when you enter CERN you basically leave 10:33:06  
14 Switzerland, right? It is a state in itself, and 10:33:09  
15 has very high standards with respect to its 10:33:13  
16 autonomy. So even if this document is in the 10:33:15  
17 CERN library, it doesn't say that it 10:33:20  
18 automatically is on the internet. There is 10:33:24  
19 a huge amount of documents in the CERN library 10:33:26  
20 which would also never make it to the internet 10:33:27  
21 because of all the copyright issues associated. 10:33:30  
22 Q. But a document doesn't have to be 10:33:38  
23 on the internet to be a publication under U.S. 10:33:40  
24 patent law, correct? 10:33:45  
25 A. Right. Now, if you're referring 10:33:46

1 to the -- there is a definition for public 10:33:49  
2 availability which I have put in here I believe. 10:33:53  
3 Do you want me to cite it? 10:33:58  
4 Q. Well, if you need to to answer the 10:33:59  
5 question I asked which is that a document doesn't 10:34:02  
6 have to be on the internet to be considered 10:34:05  
7 a publication under U.S. patent law? 10:34:07  
8 MR. DAVIS: Objection; form. 10:34:10  
9 THE WITNESS: Let me just pull this out 10:34:14  
10 to be really precise. (The witness reviewed the 10:34:15  
11 document.) 10:34:15  
12 Right: 10:34:27  
13 "A reference must have been made, 10:34:27  
14 known, used, sold, offered for sale, published, 10:34:30  
15 or patented or be the subject of a patent 10:34:32  
16 application by another, before the priority date 10:34:34  
17 of the patent." 10:34:36  
18 There is also a section which says the 10:34:37  
19 index is searchable so that it can be found. 10:34:40  
20 That section I have a problem finding at this 10:34:49  
21 moment. Ah, here we are, page 8, paragraph 19: 10:34:52  
22 "I understand that a reference is 10:35:00  
23 considered publicly accessible if it was ... 10:35:01  
24 publicly disseminated or (2) otherwise made 10:35:04  
25 available to the extent that persons interested 10:35:08

1 and ordinarily skilled in the subject matter or 10:35:12  
2 art, exercising reasonable diligence, could 10:35:14  
3 locate it." 10:35:17  
4 And, I mean, this is the sentence here, 10:35:20  
5 right? Because it was stored in a library 10:35:22  
6 doesn't mean it's publicly available and this is 10:35:25  
7 why I made this statement about the CERN library. 10:35:29  
8 BY MR. BUROKER: 10:35:31  
9 Q. Well the next sentence though you 10:35:31  
10 say you recognize that if it's in a library and 10:35:33  
11 it's indexed and cataloged by title or subject 10:35:35  
12 matter that's a factor that means it could be 10:35:38  
13 considered publicly accessible? 10:35:41  
14 A. Provided the library has public 10:35:44  
15 access. If there is a library which is private, 10:35:46  
16 you can't get to, and there is no public access. 10:35:48  
17 Q. Well that's not what it says in 10:35:51  
18 your declaration; you didn't say that the library 10:35:53  
19 has to be publicly accessible. 10:35:55  
20 MR. DAVIS: Objection; form. 10:35:58  
21 BY MR. BUROKER: 10:35:59  
22 Q. Did you? 10:36:00  
23 A. Can you ... where did I say that? 10:36:07  
24 Q. Well that's my point. I don't 10:36:08  
25 believe you said -- the last part of your answer 10:36:10



1 in the previous question was "provided the 10:36:11  
2 library has public access". I don't think that 10:36:14  
3 any of this text in paragraph 19 says that the 10:36:16  
4 library has to have public -- be accessible to 10:36:18  
5 the public, does it? 10:36:22  
6 MR. DAVIS: Objection; form. 10:36:24  
7 THE WITNESS: Well, take paragraph 19, 10:36:30  
8 second sentence: 10:36:32  
9 "I understand that publicly accessible 10:36:32  
10 requires that a reference must have been 10:36:36  
11 sufficiently accessible to the public interested 10:36:38  
12 in the art." 10:36:41  
13 BY MR. BUROKER: 10:36:43  
14 Q. Right, and one of the kinds of 10:36:44  
15 people who would be interested in the art would 10:36:45  
16 have been a person working on computer 10:36:47  
17 architecture as part of some of the CERN 10:36:52  
18 projects, right? 10:36:56  
19 MR. DAVIS: Objection; form. 10:36:56  
20 THE WITNESS: Not necessarily. 10:36:57  
21 BY MR. BUROKER: 10:37:00  
22 Q. Were you interested in the art? 10:37:01  
23 A. Yes. 10:37:03  
24 Q. And you could have accessed it, 10:37:03  
25 correct? 10:37:04

1	A. I have a very particular history	10:37:04
2	in this particular field, but this field is of	10:37:07
3	course much broader and larger than just nuclear	10:37:15
4	physics.	10:37:19
5	Q. Well, anybody on this RD24 status	10:37:19
6	report, any of these people would have had access	10:37:21
7	to the CERN library in 1996, correct?	10:37:23
8	A. Absolutely, yes.	10:37:25
9	Q. Among other people working on	10:37:26
10	various LHC projects?	10:37:28
11	A. Correct. Basically all CERN	10:37:31
12	users.	10:37:38
13	Q. You agree that this document was	10:37:40
14	at some point provided to the CERN library,	10:37:45
15	right?	10:37:48
16	A. Correct. Otherwise there wouldn't	10:37:50
17	be the library stamp on it.	10:37:51
18	Q. Okay. Do you have any knowledge	10:37:53
19	regarding the procedure by which this document	10:38:01
20	was provided to the CERN library?	10:38:04
21	A. I would assume it's the normal	10:38:08
22	procedure, submission to the library, library	10:38:10
23	records it, puts the stamp on it. Other than	10:38:14
24	that no, and I was not involved when this	10:38:17
25	happened.	10:38:20

1 Q. Did you ask Dr. Müller if he 10:38:20  
2 submitted it to the library? 10:38:27  
3 A. I asked him whether he had 10:38:28  
4 a recollection when it was done and he said no. 10:38:30  
5 I didn't ask him explicitly, "Did you do this?" 10:38:32  
6 but I believe that one can assume that he did. 10:38:35  
7 Q. So it's possible that he submitted 10:38:39  
8 it to the library at the same time that he 10:38:40  
9 submitted it to the CERN LHCC Committee, correct? 10:38:43  
10 A. I don't know that. 10:38:49  
11 Q. It's possible and also not 10:38:51  
12 possible, right? 10:38:54  
13 MR. DAVIS: Objection; form. 10:38:59  
14 THE WITNESS: I mean, in general, keep 10:39:00  
15 in mind the frame setting of this here, this is 10:39:02  
16 a tough review committee, you're reporting to 10:39:06  
17 such a review committee. I would never, ever 10:39:09  
18 submit an internal document I give to a reviewer, 10:39:14  
19 in particular if it contains some confidential 10:39:18  
20 information, at the same time to the library. It 10:39:20  
21 doesn't seem to be the -- this is not the right 10:39:29  
22 process. I mean it goes to the review committee, 10:39:31  
23 there are reports written about that and if 10:39:33  
24 anything, at some point, the whole package with 10:39:35  
25 recommendations of the reviewers and so forth 10:39:40

1           would possibly make it then to the library as           10:39:43  
2           a final result of a complete process.           10:39:46  
3                       Now, since this process was an ongoing           10:39:49  
4           thing, prior to the review I would have certainly           10:39:52  
5           not expected anybody to submit something to the           10:39:56  
6           library. It may also be that the LHC Committee           10:39:58  
7           at some point later, for instance at the           10:40:02  
8           conclusion of the RD24 project, took the whole           10:40:05  
9           package and submitted it to the library. I don't           10:40:09  
10          know the exact process that happened here.           10:40:11  
11          BY MR. BUROKER:           10:40:15  
12                       Q.    Do you have any expertise or           10:40:15  
13          knowledge about CERN library's procedures?           10:40:18  
14                       A.    Not in depth. I'm using the           10:40:21  
15          library of course, but we submit our documents to           10:40:23  
16          our own libraries, but the procedures how           10:40:30  
17          libraries work are relatively simple.           10:40:35  
18                       Q.    Do you know whether the CERN           10:40:37  
19          library, as part of its normal practice back in           10:40:38  
20          1996, would receive copies of everything sent to           10:40:41  
21          the HCCC (sic)?           10:40:44  
22                       MR. DAVIS: Objection; form.           10:40:48  
23          BY MR. BUROKER:           10:40:50  
24                       Q.    Excuse me to the LHCC. I used the           10:40:50  
25          wrong acronym.           10:40:53

1 MR. DAVIS: Objection; form. 10:40:55

2 THE WITNESS: I would doubt that since 10:41:00

3 you said "everything". 10:41:01

4 BY MR. BUROKER: 10:41:02

5 Q. Do you know whether, as part of 10:41:02

6 the normal procedures, the LHCC would provide 10:41:05

7 copies of status reports to the library? 10:41:10

8 A. I'm not aware that all my status 10:41:21

9 reports -- and I wrote a lot of them -- for my 10:41:23

10 own projects I had later for the LHC project were 10:41:25

11 all submitted to the library, I'm not aware of 10:41:31

12 that. Now, I haven't though done an in-depth 10:41:33

13 search, but I would find it highly unusual and 10:41:37

14 inappropriate in particular since I wasn't asked. 10:41:42

15 Q. Is there a physical library still 10:41:44

16 at CERN? 10:41:49

17 A. Oh yes. 10:41:50

18 Q. And so you visited the library 10:41:50

19 during the '96 to '98 timeframe? 10:41:53

20 A. Yeah, from time to time, it's 10:41:57

21 pretty big. 10:41:58

22 Q. And at that time was there also a 10:41:59

23 network-based access to the library's database, 10:42:04

24 so that if somebody were looking to see what was 10:42:08

25 available and you were in California, for 10:42:10

1           example, could you link in to find out what was           10:42:12  
2           there?           10:42:15

3                   A.    I never did that from California,           10:42:16  
4           certainly not when at CERN.  I went there.           10:42:18  
5           Whether they had an electronic index already at           10:42:22  
6           that time I'm not sure, I don't remember.  I           10:42:25  
7           still remember they have even these huge rows,           10:42:28  
8           where you have all these little library cards,           10:42:33  
9           with the index and so forth as it used to be.           10:42:38

10                  Q.    Did you attempt to contact anyone           10:42:45  
11           with a CERN library connection with trying to           10:42:48  
12           determine whether or not this Bogaerts reference           10:42:51  
13           was --           10:42:57

14                  A.    I did not.           10:42:57

15                  Q.    -- publicly available?           10:42:58  
16           Have you submitted documents to the CERN           10:43:00  
17           library in the past?           10:43:04

18                  A.    Directly, no.  And this is highly           10:43:08  
19           unusual, wouldn't do that.  The way it works is           10:43:11  
20           the CERN library is -- a library usually doesn't           10:43:19  
21           accept ordinary work in progress or status report           10:43:25  
22           material.  The library usually wants finalized           10:43:29  
23           documents: a thesis, an approved paper.  There is           10:43:33  
24           this area of grey literature, which is what we           10:43:39  
25           call preprints, almost the proof paper, so papers           10:43:41

1 submitted for acceptance. CERN has a rather 10:43:44  
2 complex way of accepting publications so, unlike 10:43:49  
3 in other areas where we have this rule of freedom 10:43:54  
4 to publish anything you want, at CERN you can't 10:43:59  
5 do that. If I wish to write a paper in the 10:44:03  
6 context of a CERN experiment it has to be 10:44:05  
7 submitted first to the committee inside CERN, the 10:44:07  
8 committee will review that, we're talking 10:44:09  
9 something like ten people typically on such 10:44:11  
10 a committee. The paper is being iterated many, 10:44:13  
11 many times, it can take half a year, sometimes 10:44:19  
12 a year before it's approved. Once it's approved 10:44:22  
13 it's submitted for publication with a CERN 10:44:24  
14 approval, and once the paper is accepted for 10:44:29  
15 publication then by the book or magazine, whoever 10:44:33  
16 publishes, Phys Ref Letters and so forth, then it 10:44:39  
17 would make its way into the library and that, 10:44:44  
18 again, only under certain conditions because 10:44:46  
19 there are publishing agencies which forbid that 10:44:49  
20 and then you find in the library only a reference 10:44:52  
21 saying if you want a copy of that document you 10:44:55  
22 have to either go to the publishing house. In 10:44:57  
23 case of Phys Ref Letters CERN of course has 10:45:02  
24 bought a license to that magazine. 10:45:09  
25 Q. Wait, are you saying "list of 10:45:10

1 letters"? What are you saying? 10:45:11

2 A. Physical Review Letters. 10:45:14

3 Q. Okay, I apologize. She's not 10:45:15

4 getting it and we want a clear record. 10:45:17

5 A. That's fine, Phys Ref Letters is 10:45:20

6 the short form. I apologize for that. They are 10:45:25

7 always cited as that and this is -- 10:45:28

8 Q. Phys Ref, okay, I got you. 10:45:28

9 A. Yeah. Because they have very high 10:45:29

10 impact points, and this is, in physics, very 10:45:32

11 important to have a publication in Phys Ref. 10:45:34

12 But, for example, if you publish it in certain 10:45:38

13 magazines, they do not allow you to use it 10:45:43

14 anywhere else, you also have to buy then the 10:45:47

15 magazine and that means for this particular 10:45:50

16 magazine there is no electronic version, you have 10:45:52

17 to go to the CERN library and pull the physical 10:45:55

18 paper out of the shelf to be able to read it and 10:45:58

19 make copies and so forth. 10:46:03

20 There is a long and ongoing debate, not 10:46:04

21 settled, about all of this, because it turns out 10:46:07

22 that the electronic version of a paper often is 10:46:13

23 more expensive than just buying the paper version 10:46:16

24 of a magazine, but the paper version is highly 10:46:18

25 inconvenient because, you know, it takes a lot of 10:46:22



1 time before you have it and so forth. But the 10:46:24  
2 fact is, if all these conditions are met, a paper 10:46:29  
3 approved for publication is out there, it is real 10:46:32  
4 and the paper is part of the stuff the library 10:46:36  
5 buys anyway. I mean Phys Ref Letters costs 10:46:41  
6 something like 30 or 40,000 a year if I remember 10:46:45  
7 correctly, really expensive. Then you can have 10:46:47  
8 it in the library. It's not yet on the internet; 10:46:49  
9 only if CERN also acquired an internet license 10:46:54  
10 for that magazine and it is also available. 10:46:58  
11 So, you see, this is absolutely a 10:47:00  
12 non-trivial thing and libraries have to be 10:47:03  
13 really, really careful. Imagine even just one 10:47:06  
14 version of a copyrighted paper ends up on the 10:47:09  
15 internet without approval, you immediately have 10:47:13  
16 all the litigation for damages and so forth. 10:47:15  
17 Q. So I think that the question was 10:47:20  
18 whether you had ever submitted the document to 10:47:23  
19 CERN for publication and the answer was no, 10:47:26  
20 right? 10:47:30  
21 A. I would submit it to the 10:47:30  
22 committee, the committee would publish it and 10:47:31  
23 then, as part of the automatic process, it would 10:47:33  
24 eventually end up in the library. So, strictly 10:47:36  
25 spoken, directly? No. Indirectly according to 10:47:39

1 the procedure set forth? Yes. 10:47:42

2 Q. So some documents that you've 10:47:44

3 submitted to committee have been published or are 10:47:47

4 part of the publications of the CERN library but 10:47:53

5 through the committee process; is that right? 10:47:55

6 A. Yeah. 10:47:57

7 MR. DAVIS: Objection; form. 10:47:57

8 BY MR. BUROKER: 10:47:57

9 Q. And that's the same committee, the 10:48:00

10 LHCC Committee or is there a different Committee 10:48:02

11 you're referring to? 10:48:04

12 A. No, no, no totally different. The 10:48:04

13 LHCC Committee is only there to monitor the 10:48:06

14 process of development work for LHC-related 10:48:08

15 experiments or accelerator, okay? Now we have 10:48:13

16 LHC in operation since a couple of years and 10:48:23

17 experiments are taking data and analyzing data. 10:48:31

18 So, for instance, I'm a member of the ALICE 10:48:33

19 Collaboration. This is 1,100 scientists. So 10:48:36

20 a publication like this one, has a two- or 10:48:39

21 three-page front page stating all the times -- 10:48:43

22 right, 1,000 names is a lot of stuff -- with all 10:48:45

23 the affiliations, and inside ALICE we have 10:48:49

24 a Publication Committee which has at least five 10:48:56

25 or six subgroups focusing at different subfields 10:49:01

1 of the physics which ALICE does. And every 10:49:04  
2 single paper goes through that process. There is 10:49:08  
3 even a mitigation framework there. So, for 10:49:13  
4 example, if the author doesn't agree with what 10:49:17  
5 the committee wants changed, then it's escalated, 10:49:19  
6 worst case, to the ALICE Management Board and 10:49:22  
7 a decision is being made and so forth. But this 10:49:25  
8 is now a scrutiny process which is inside ALICE. 10:49:28  
9 On top of that it's really highly complicated. 10:49:33  
10 If you have what is considered 10:49:38  
11 a discovery-level publication, you found a new 10:49:42  
12 particle, even then ALICE cannot publish it. 10:49:44  
13 Then it goes to the CERN Director and the CERN 10:49:48  
14 Director will put a hold on that paper until he's 10:49:52  
15 convinced that (a) it is absolutely solid and 10:49:55  
16 correct and (b) if there is the possibility of 10:50:00  
17 a second CERN experiment measuring it he likes to 10:50:03  
18 see them measuring it, too, to have a second 10:50:06  
19 validation. You may remember the cold fusion 10:50:09  
20 case which happened in Germany and somebody made 10:50:12  
21 huge noise, big press media, about having found a 10:50:16  
22 way to do fusion basically in the laboratory and 10:50:22  
23 that was a hoax; big embarrassment for everybody. 10:50:26  
24 So CERN has put a very, very high level of 10:50:30  
25 scrutiny to avoid this from happening and yet you 10:50:35

1           may have noticed the big press campaign about           10:50:38  
2           CERN having measured a particle traveling faster       10:50:40  
3           than the speed of light, which was wrong and yet       10:50:42  
4           it went out. So even there the scrutiny failed.       10:50:46  
5                   Q.    So I'm going to ask you to listen       10:50:54  
6           to my questions and answer those questions. I       10:50:55  
7           know you like to go on and explain your answers,       10:50:58  
8           and I mean your counsel can ask you follow-up       10:51:01  
9           questions if he needs to. My question was: was       10:51:03  
10          it a different committee?                               10:51:07  
11                   A.    Yes.                                       10:51:08  
12                   Q.    Thank you. In the 1996 timeframe,       10:51:08  
13           when the Exhibit 1011 was submitted, do you know       10:51:21  
14           what the procedure was for LHCC to submit           10:51:27  
15           a document to the library? If there is such           10:51:35  
16           a procedure?   10:51:38  
17                   MR. DAVIS: Objection; form.                   10:51:39  
18                   THE WITNESS: No explicit set of rules       10:51:45  
19           comes to my mind, except that it's the same           10:51:49  
20           standard procedure how libraries worked. No           10:51:53  
21           particular rules I remember.                           10:51:56  
22           BY MR. BUROKER:                                       10:52:02  
23                   Q.    Do you recall personally               10:52:02  
24           submitting this report to anyone after it was       10:52:05  
25           submitted to the LHCC?                               10:52:11

1	A. No.	10:52:13
2	Q. Do you know whether Dr. Müller	10:52:14
3	submitted this document to anyone other than the	10:52:18
4	LHCC at that time in 1996?	10:52:22
5	A. No, and I was surprised because	10:52:26
6	there were quite a few confidentiality agreements	10:52:28
7	associated with this.	10:52:31
8	Q. Right. So you do give some	10:52:37
9	testimony in your declaration about	10:52:39
10	confidentiality.	10:52:42
11	Paragraph 170, for example, of the '814	10:52:47
12	declaration says that:	10:52:54
13	"... it is likely that the RD24 status	10:52:59
14	report would NOT have been published on that date	10:53:01
15	because it was subject to confidentiality	10:53:04
16	agreements."	10:53:06
17	A. That's correct.	10:53:06
18	Q. You don't cite to what those	10:53:07
19	confidentiality agreements are in this	10:53:12
20	declaration, correct?	10:53:15
21	A. Yes, correct.	10:53:16
22	Q. And the document itself doesn't	10:53:17
23	have any confidentiality labels that I've been	10:53:21
24	able to find. Have you been able to find any?	10:53:24
25	A. I did not, no. Although I didn't	10:53:27

1 explicitly look for them but no. 10:53:31

2 Q. And you agree that, as of 2014 at 10:53:58

3 least, or 2015, this document is now publicly 10:54:04

4 accessible, correct? 10:54:09

5 MR. DAVIS: Objection; form. 10:54:12

6 THE WITNESS: The big question is now 10:54:16

7 what do you mean with "this document"? If you 10:54:18

8 mean the version with the CERN library stamp as 10:54:20

9 it was then, yes, one can find it now through the 10:54:24

10 internet on the CERN library pages. I Googled 10:54:35

11 for it and I did find it, yes. 10:54:40

12 BY MR. BUROKER: 10:54:43

13 Q. Okay. And you don't have any 10:54:43

14 information about when between 1996 and 2014 this 10:54:44

15 did become publicly available, correct? 10:54:54

16 A. Correct, I cannot tell you the 10:54:56

17 date. 10:54:57

18 Q. And Dr. Müller couldn't tell you 10:54:59

19 the date, correct? 10:55:02

20 A. No. Yeah, correct. Yes, I should 10:55:03

21 say something here. You've just asked a negative 10:55:07

22 question, right? "Could not". 10:55:12

23 Q. Yeah, and if you want to -- 10:55:14

24 A. No, no, to make it clear, I tried 10:55:16

25 to be very correct here and there is a little but 10:55:19

1           nasty pitfall; the correct answer to a negative           10:55:23  
2           question in the U.S. is "no". The affirmative           10:55:28  
3           answer to a negative question is "no" -- is           10:55:31  
4           "yes", sorry, in Germany it is "no".           10:55:35  
5                   Q.    Okay, let me ask it again.           10:55:37  
6                   Did Dr. Müller know when this document           10:55:39  
7           became publicly available?           10:55:45  
8                   A.    He could not tell, arguing, "This           10:55:46  
9           is almost 20 years ago, how would I know? This           10:55:49  
10          is more than 20 years ago when I wrote this, how           10:55:53  
11          would I know?"           10:55:56  
12                  Q.    There's some discussion in the           10:56:14  
13          declaration about -- I guess it starts on           10:56:15  
14          paragraph 174 -- about the internet linking of           10:56:18  
15          this report, or a copy of this report. So I want           10:56:25  
16          to ask you some questions about that.           10:56:32  
17                  You say in your declaration at           10:56:35  
18          paragraph 176 that you believe:           10:56:38  
19                  "... that the RD24 status report           10:56:42  
20          was ...           10:56:42  
21                  -- which is the Bogaerts reference, and           10:56:46  
22          let me find the right language:           10:56:50  
23                  "... inadvertently linked to a public           10:56:52  
24          web page on Mr. Müller's private web server and           10:56:55  
25          was later removed."           10:56:58

1 Do you see that at the end of 176? 10:56:59

2 A. Yes. 10:57:05

3 Q. Did you discuss this piece of 10:57:14

4 information with Mr. Müller? 10:57:16

5 A. No. 10:57:17

6 Q. You didn't ask him? 10:57:18

7 A. I did not. I didn't see any point 10:57:19

8 because -- no, I didn't ask, no. 10:57:22

9 Q. What is the basis for your 10:57:27

10 statement that you believe it was "inadvertently 10:57:29

11 linked"? 10:57:33

12 A. The machine sunshine is one of the 10:57:37

13 machines that Hans Müller used at that time. 10:57:44

14 Although it's long ago I still remember that 10:57:50

15 because it was these nice shiny flat boxes and 10:57:52

16 quite expensive, I wanted one, too, but at first 10:57:57

17 I didn't have one, so these are the things you 10:57:59

18 remember. And since it's the machine built by 10:58:01

19 Sun Microsystems he called them sunshine and the 10:58:06

20 other one was called sunrise, being the machines 10:58:09

21 of the RD24 project basically his personal 10:58:13

22 machines he used to work with. 10:58:17

23 And you see that the URL specified here 10:58:18

24 has this ":8080" after it. This is the URL or 10:58:30

25 HTTP syntax which specifies the port number. The 10:58:38



1 port number is a number used in the internet to 10:58:41  
2 identify a particular sub-functionality of 10:58:45  
3 a computer. The official port number for 10:58:48  
4 internet web access -- the World Wide Web -- is 10:58:51  
5 port 80. Most of the computers at the time came 10:58:54  
6 already with a private web server built in, used 10:58:58  
7 for all sorts of maintenance functionality and so 10:59:01  
8 forth. And usually if you just wanted to set up 10:59:05  
9 something for your own contacts and work you 10:59:09  
10 might use a different port number and Hans Müller 10:59:13  
11 invented 8080. Obviously it is clear where it 10:59:17  
12 comes from. This number has to be between one 10:59:19  
13 and 65,535, so you have roughly 65,000 options. 10:59:22  
14 However, the internet search engines usually use 10:59:32  
15 the internet addresses, so port 80, right? So if 10:59:38  
16 you typed www.ibm.com, you'd definitely end up at 10:59:42  
17 a port of 80. So, from that point of view 10:59:49  
18 an ordinary search engine -- and one should know 10:59:57  
19 at that time there were not that many search 11:00:00  
20 engines, I'm not sure Google already existed at 11:00:03  
21 all -- that would look for any other port. And 11:00:08  
22 it would not be successful if you were to try to 11:00:11  
23 just screen whether or not a computer is using 11:00:14  
24 another port because that would be detected by 11:00:17  
25 the computer security infrastructure and you 11:00:21

1 would be considered a hacker and you would be 11:00:23  
2 blocked completely. CERN does that completely 11:00:27  
3 automatically. 11:00:29  
4 So for this document to be found there 11:00:32  
5 must have been -- by any web crawler, as these 11:00:34  
6 machines are being called, you know, which go on 11:00:40  
7 websites, try to read everything, store it 11:00:43  
8 somewhere and then follow links, the only 11:00:47  
9 reasonable way for this to be done, would be that 11:00:49  
10 some link somewhere would have redirected to this 11:00:53  
11 point. This is the rationale behind that 11:00:58  
12 statement. 11:01:00  
13 Q. Okay, but the fact of the matter 11:01:00  
14 is it was linked and captured by the internet 11:01:02  
15 archive in 1996, right? 11:01:07  
16 A. That document was submitted, yes, 11:01:10  
17 although this is, if I remember correctly, only 11:01:13  
18 part of it some different pages, but they have 11:01:16  
19 certain fraction of it, yes. 11:01:19  
20 Q. Well, they have a postscript 11:01:24  
21 file that if you click on it you get the entire 11:01:26  
22 document, correct? Did you try it? 11:01:29  
23 MR. DAVIS: Objection; form. 11:01:30  
24 BY MR. BUROKER: 11:01:32  
25 Q. Did you personally visit this U -- 11:01:32

1 looking in paragraph 174, there's a URL, there's 11:01:37  
2 two URLs. The top one -- excuse me, the second 11:01:47  
3 one is a postscript file, correct? 11:01:52  
4 A. The second? 11:01:55  
5 MR. DAVIS: Objection; form. 11:01:56  
6 BY MR. BUROKER: 11:01:59  
7 Q. The second link? 11:01:59  
8 A. So the second link and you're 11:02:00  
9 referring to the HTTP "web.archive.../web" and 11:02:03  
10 then all sorts of long numbers, 11:02:07  
11 "sunshine.cern.ch:8080...RD2496\_1.ps". Yeah, the 11:02:10  
12 extension ".ps" indicates it's be to a postscript 11:02:17  
13 file. 11:02:20  
14 Q. Right. And did you visit that 11:02:20  
15 URL? 11:02:23  
16 A. I'm not sure. 11:02:24  
17 Q. And did you visit that URL and 11:02:27  
18 click on that link and see what response you got 11:02:32  
19 back? 11:02:34  
20 A. I can't tell you. I did click on 11:02:38  
21 a few of those references but for this particular 11:02:42  
22 one I can't tell you. 11:02:48  
23 Q. And a postscript file is an Adobe 11:02:49  
24 file format that builds a PDF, correct? 11:02:54  
25 A. No. 11:02:58

1	Q. What is a postscript file?	11:02:58
2	A. At the time we're discussing here,	11:03:07
3	1996, PDF did not exist. Postscript is a page	11:03:09
4	description language, which was invented by Adobe	11:03:13
5	also, which basically has all elements to	11:03:16
6	basically print any kind of document, any form,	11:03:22
7	any kind of graphics, whatsoever. It's a page	11:03:26
8	description language in the strictest sense, it	11:03:33
9	has commands in there, certain rules. So, for	11:03:36
10	example, if you have a text and it has to be	11:03:41
11	modified then there are commands saying make this	11:03:42
12	boldface and underscored and what-not. So the	11:03:45
13	text of the document is basically encapsulated	11:03:47
14	inside the whole postscript context. There is	11:03:49
15	a lot of declaration stuff at the beginning, if	11:03:55
16	you look through it. And, in particular, if you	11:03:57
17	look at the text version of this document you	11:03:59
18	will find that you will not be able to read this,	11:04:02
19	right? Because the text basically disappears in	11:04:04
20	all the commands.	11:04:09
21	PDF -- the portable data format -- is	11:04:10
22	something which was introduced by Adobe later for	11:04:13
23	many reasons. One reason was that postscript	11:04:18
24	turned out not being as portable and as easily	11:04:23
25	reproducible as people like them to -- I still	11:04:27

1 remember infinite sessions where we spent hours 11:04:31  
2 because the printer just wouldn't print that 11:04:35  
3 file. It looked fine on screen, you saw 11:04:37  
4 everything, it was perfect, but the printer 11:04:41  
5 wouldn't print it, or what came out was complete 11:04:42  
6 nonsense. Even when I went back to Heidelberg, I 11:04:45  
7 still remember a lot of effort we had to put in 11:04:52  
8 because, for example, it would happen that 11:04:56  
9 a printer disregarded the first command saying, 11:04:58  
10 "This is postscript", and then you would end up 11:05:01  
11 having 500 pages of postscript commands for 11:05:04  
12 a single-page document because sometimes it would 11:05:07  
13 even, you know, one-command-per-line kind of 11:05:10  
14 nonsense. All of this was a problem because the 11:05:12  
15 document which can't reliably print and 11:05:16  
16 reproducibly print in every country, big issues 11:05:18  
17 between U.S. letter format and European A4, that 11:05:21  
18 was solved by introducing PDF, the really 11:05:25  
19 portable data format. And postscript is 11:05:28  
20 basically not being used anymore. There are 11:05:31  
21 converters which are automatically evoked if you 11:05:34  
22 open a postscript file and this was why people 11:05:37  
23 tend to believe that postscript is basically part 11:05:41  
24 of PDF but it's not. 11:05:44  
25 Q. Okay, but in '96, if you had 11:05:46

1 a postscript file in the relevant linked 11:05:48  
2 references, you could generate something to be 11:05:53  
3 printed? Is that what the purpose of postscript 11:05:56  
4 files was? 11:05:59  
5 MR. DAVIS: Objection; form. 11:06:00  
6 THE WITNESS: You would have to 11:06:01  
7 download it and then depending on what kind of 11:06:06  
8 web browser you had, usually not automatically at 11:06:09  
9 this time if I remember correctly, you would have 11:06:12  
10 to have a postscript viewer to view this 11:06:14  
11 postscript file to have it on screen, and you 11:06:17  
12 would have to have a postscript-enabled printer 11:06:19  
13 which would understand postscript and those 11:06:22  
14 printers were more expensive because they needed 11:06:24  
15 a postscript interpreter which is a rather 11:06:26  
16 complex piece of software and lots of memory for 11:06:30  
17 it to be able then turn this into something on 11:06:32  
18 paper. 11:06:35  
19 BY MR. BUROKER: 11:06:46  
20 Q. Let me show you what's been 11:06:46  
21 previously marked as Exhibit 2026 in the '1469 11:06:48  
22 IPR proceeding. This is an affidavit of 11:06:59  
23 Christopher Butler from the Internet Archive. 11:07:02  
24 Have you ever viewed this document as one of the 11:07:05  
25 things you considered? 11:07:08

1 A. I have looked at it, yes. 11:07:09

2 Q. Okay, and he attaches materials 11:07:11

3 that were from the Internet Archive from October 11:07:14

4 -- strike that -- from January 26th, 1997; is 11:07:26

5 that correct? 11:07:32

6 MR. DAVIS: Objection; form. 11:07:35

7 THE WITNESS: Which particular page are 11:07:38

8 you now referring to? 11:07:40

9 BY MR. BUROKER: 11:07:42

10 Q. I strike that. I'm more 11:07:42

11 interested in the documents that were 11:07:43

12 from October 29, 1996. So it's the one that 11:07:48

13 starts on page 11 of this document. 11:07:53

14 MR. DAVIS: Objection; form. 11:07:59

15 BY MR. BUROKER: 11:08:01

16 Q. 011. So, the question is: in 11:08:03

17 paragraph 6 of his affidavit, he says: 11:08:23

18 "Attached ... as Exhibit A are true and 11:08:26

19 accurate copies of printouts of the Internet 11:08:28

20 Archive's records of the HTML and PDF files for 11:08:32

21 the URLs and the dates specified in the footer of 11:08:36

22 the printout (for HTML) or on the attached 11:08:40

23 coversheet (for PDF)." 11:08:42

24 MR. DAVIS: Objection; form. 11:08:44

25 /// 11:08:46

1	BY MR. BUROKER:	11:08:46
2	Q. Is that what it says?	11:08:46
3	A. This is what is written here, yes.	11:08:49
4	Q. Okay. So on page 11 there's a URL	11:08:53
5	and that's the URL that we were just talking	11:09:01
6	about from your declaration; is that right?	11:09:03
7	MR. DAVIS: Objection; form.	11:09:07
8	THE WITNESS: I would have to compare.	11:09:09
9	If you say so.	11:09:12
10	BY MR. BUROKER:	11:09:15
11	Q. It was paragraph 174.	11:09:15
12	A. Yes.	11:09:17
13	Q. Okay. And then what is attached	11:09:33
14	next, on pages 12 through 49, appears to be the	11:09:36
15	RD24 status report that is the same as the EMC	11:09:46
16	Exhibit 1011 without the library stamp. Do you	11:09:55
17	agree?	11:09:58
18	MR. DAVIS: Objection; form.	11:09:59
19	THE WITNESS: By looking at it I would	11:10:03
20	say so, yes. However, I have not done a direct	11:10:06
21	one-to-one comparison. There may be an earlier	11:10:10
22	version, but since it's dated October 2nd,	11:10:12
23	I would assume so. But please note this is not	11:10:16
24	the entire document, the document was broken up	11:10:18
25	into several pieces, so there is an RD2496_1, _2,	11:10:20



1           \_3. 11:10:20

2           BY MR. BUROKER: 11:10:20

3                   Q.    Right. 11:10:36

4                   A.    And although I don't know the 11:10:37

5           reason -- \_4 even. Let me see, is there another 11:10:39

6           one? I don't remember the reason for doing this. 11:10:43

7           The most likely cause would be this document is 11:10:47

8           filled with pictures and pictures were real full 11:10:52

9           having postscript files to print, or printers to 11:10:55

10          choke when the whole postscript file was 11:10:58

11          submitted, so postscript files then were chopped 11:11:01

12          up into smaller pieces, let alone to be able to 11:11:04

13          print the stuff which would print and isolate the 11:11:06

14          potential error. So this is basically fragments 11:11:11

15          of the whole document. 11:11:14

16                  Q.    Right. 11:11:16

17                  A.    But they are all there. 11:11:17

18                  Q.    Right. In fact there are eight. 11:11:18

19          Page 46 of this has the file header for 11:11:22

20          RD2496\_8.ps, correct? 11:11:29

21                  A.    Eight, yeah, you're right. 11:11:33

22                  Q.    So if you took the pieces of the 11:11:34

23          document from each of the different RD2496 11:11:36

24          postscript files and put them together, did you 11:11:39

25          do a comparison as to whether that compilation is 11:11:41

1 the same as Exhibit 1011 minus the CERN library 11:11:45  
2 stamp? 11:11:50

3 MR. DAVIS: Objection to form. 11:11:51

4 THE WITNESS: I did not do an in-depth 11:11:53  
5 comparison whether or not they are word by word 11:11:57  
6 the same, but I did check that overall they 11:12:00  
7 looked to be the same, same page numbers. 11:12:05  
8 Nothing obvious came to mind and I would not see 11:12:08  
9 any reason why this would be a different version. 11:12:12

10 BY MR. BUROKER: 11:12:15

11 Q. Right. And so for them to have 11:12:15  
12 been -- for these postscript files to have been 11:12:18  
13 gathered by the Internet Archive on October 29th, 11:12:24  
14 1996, by that time somebody would have had to 11:12:27  
15 place those postscript files on the 11:12:34  
16 sunshine.cern.ch:8080 server, correct? 11:12:37

17 MR. DAVIS: Objection; form. 11:12:48

18 THE WITNESS: This archive claims that 11:12:50  
19 these documents were downloaded from 11:12:54  
20 sunshine.cern.ch:8080. This is what I 11:13:00  
21 understand. 11:13:05

22 BY MR. BUROKER: 11:13:06

23 Q. And you have no reason to doubt 11:13:06  
24 the Christopher Butler affidavit, do you? 11:13:07

25 A. No, I mean I believe he signed 11:13:10

1	that under oath, right?	11:13:12
2	Q. So do you know who put those	11:13:14
3	postscript files on that sunshine.cern.ch:8080	11:13:19
4	server?	11:13:25
5	A. I don't know but it would be	11:13:28
6	relatively likely that this was Hans Müller, and	11:13:31
7	it was also very possible that -- because these	11:13:40
8	documents have a certain size particular to	11:13:43
9	postscript -- that this was the place where	11:13:45
10	everybody was referring to to look at the final	11:13:49
11	document and to say it's all right as part of the	11:13:52
12	work in progress. But remember this is the	11:13:56
13	private web page of the RD24 and not an official	11:13:58
14	generic searchable web page.	11:14:03
15	Q. Well you say it's private but it's	11:14:06
16	on the CERN server, right?	11:14:08
17	A. CERN has about 10,000 computers.	11:14:11
18	So it's one particular computer of one person	11:14:14
19	working at CERN -- there are 3,000 employees --	11:14:19
20	who is using this on a sub-web page which is not	11:14:24
21	part of the official port 80 web pages. So if	11:14:31
22	you would go to www.cern.ch you would not find	11:14:35
23	this, right? This is something else.	11:14:38
24	Q. Well, but CERN owned the computer,	11:14:42
25	right?	11:14:44

1 MR. DAVIS: Objection; form. 11:14:44

2 BY MR. BUROKER: 11:14:44

3 Q. You're trying to draw some 11:14:49

4 distinction and say it's private, but this is 11:14:50

5 a cern.ch address. 11:14:55

6 A. Yeah, but the conclusion you're 11:15:00

7 trying to draw is really wrong. I have computers 11:15:02

8 at CERN worth millions of euros which are owned 11:15:07

9 by the government in Germany because they're paid 11:15:10

10 for by the German Research Council BMBF, but they 11:15:12

11 are at CERN. And since they are for a CERN 11:15:16

12 experiment they are, of course, operating in the 11:15:19

13 CERN computer contacts and if you want to get 11:15:23

14 them they have a CERN network address. 11:15:25

15 Q. But Müller chose to put these on 11:15:29

16 an address that was a cern.ch address and not, 11:15:35

17 you know, drmüller.com or some other URL he could 11:15:38

18 have used, right? 11:15:44

19 MR. DAVIS: Objection; form. 11:15:45

20 THE WITNESS: Every computer at CERN -- 11:15:51

21 I mean maybe we should enter briefly into a 11:15:54

22 discussion how networks work because I believe 11:15:56

23 there is a misunderstanding here. 11:16:01

24 If I would bring my laptop -- 11:16:05

25 BY MR. BUROKER: 11:16:07

1 Q. Well that's not an answer to my 11:16:07  
2 question, sir. I asked you a question about 11:16:09  
3 whether Mr. Müller or Dr. Müller choose to put 11:16:11  
4 these on a cern.ch addressed server. 11:16:14  
5 MR. DAVIS: Objection; form. 11:16:19  
6 THE WITNESS: He put it on a computer 11:16:21  
7 which belonged to the RD24 project which was 11:16:23  
8 located at CERN and thereby had a CERN network 11:16:30  
9 address, like every guest or every person 11:16:33  
10 visiting CERN having a CERN network address. 11:16:37  
11 Like every person in this room going on to the 11:16:42  
12 network, getting a network address in the domain 11:16:44  
13 of your law firm. 11:16:48  
14 BY MR. BUROKER: 11:16:52  
15 Q. Right. And so if I posted 11:16:52  
16 something on my firm's network, it wouldn't be my 11:16:55  
17 private server, just as this was not really his 11:16:57  
18 private server. It's a piece of equipment owned 11:17:00  
19 by his employer and on his employer's URL, 11:17:03  
20 correct? 11:17:08  
21 MR. DAVIS: Objection; form. 11:17:09  
22 THE WITNESS: This is what I tried to 11:17:11  
23 outline. CERN is not just an employer which owns 11:17:12  
24 everything which is part of CERN. CERN is 11:17:17  
25 an international organization with lots of highly 11:17:20

1 complicated contracts with lots of entirely 11:17:22  
2 autonomously operating organizations. So, for 11:17:27  
3 example, the ALICE experiment has nothing to do 11:17:30  
4 with CERN although it is located at CERN. We 11:17:33  
5 have our own rules, we even have our own bank 11:17:37  
6 accounts at CERN, although they are under 11:17:40  
7 diplomatic immunity. Nobody can get to these 11:17:44  
8 accounts unless the account owner, in one case 11:17:46  
9 myself, approves that. Same for the computers. 11:17:48  
10 If there is a particular project it has its own 11:17:52  
11 set of contacts and ownerships and the fact that 11:17:56  
12 the computer are located at CERN only means that 11:18:03  
13 they get a CERN address but that doesn't mean 11:18:06  
14 that the contents in these computers are owned by 11:18:08  
15 CERN or necessarily the computer is owned by 11:18:11  
16 CERN. The ownership of sunshine I don't know. 11:18:14  
17 RD24 had different funding sources and how the 11:18:17  
18 money came together to, for instance, buy those 11:18:23  
19 machines, I can't tell at this point, but you 11:18:26  
20 cannot automatically draw the conclusion that 11:18:29  
21 this is an employee-employee relationship and 11:18:31  
22 everything that is under the CERN, inside the 11:18:34  
23 CERN domain is owned by CERN. 11:18:37  
24 BY MR. BUROKER: 11:18:39  
25 Q. But you've drawn a conclusion and 11:18:39

given an opinion under oath that it was his  
private server; is that correct?

A. Private server in the sense of the RD24 project, yes. Not private server in the sense he owned it personally privately. This is the RD24 project and in this context his private server, yeah.

Q. Often private is used to distinguish between public; was that the distinction you were trying to draw? Or what was the reason why you said it was a private server?

MR. DAVIS: Objection to form.

THE WITNESS: Both. This is a machine belonging to the RD24 project and the information on there was for the RD24 project, inside the RD24 project, and not for the public and consequently, therefore, I used the word "private".

BY MR. BUROKER:

Q. Was he an employee of CERN?

A. Hans Müller was an employee of CERN, correct.

Q. Is he still an employee of CERN?

To your knowledge obviously?

A. He has reached the age of

1 retirement. He may still be or already have 11:19:52  
2 retired but he is still working at CERN, which is 11:19:57  
3 rather common. People do research because they 11:20:01  
4 like to do that and they keep doing this after 11:20:07  
5 their retirement. So he may or may not be at 11:20:09  
6 this point. 11:20:12

7 Q. Just to be clear, so we know what 11:20:13  
8 the facts are. So what's your understanding as 11:20:16  
9 to who owns the cern.ch domain? 11:20:19

10 MR. DAVIS: Objection to form. 11:20:23

11 THE WITNESS: The cern.ch domain is 11:20:28  
12 registered by the organization CERN. So from 11:20:33  
13 that point of view you can argue that CERN owns 11:20:35  
14 it. 11:20:37

15 BY MR. BUROKER: 11:20:50

16 Q. And if I visit a www.cern.ch URL, 11:20:50  
17 is that going to be a CERN website? 11:20:59

18 A. That would be the CERN official 11:21:03  
19 website, organized by the CERN public relations 11:21:05  
20 department, run by the CERN IT department. 11:21:09

21 Q. And the contents of that website 11:21:12  
22 would be served off of a CERN server; is that 11:21:13  
23 correct? 11:21:13

24 A. That I would assume so to be 11:21:19  
25 correct. 11:21:21



1 Q. Are you familiar with the URL 11:21:23  
2 cds.cern.ch? 11:21:25  
3 A. Where is that? 11:21:32  
4 Q. I don't know if it's in your 11:21:35  
5 declaration or not. 11:21:37  
6 A. Outside the context I may or may 11:21:39  
7 not know, I would need to look at it to be sure. 11:21:41  
8 Q. It doesn't immediately come to 11:21:47  
9 mind as being the CERN Document Server that's 11:21:49  
10 associated with the CERN library; is that 11:21:54  
11 correct? 11:21:57  
12 A. Well, the CERN Document Server 11:21:58  
13 I am of course aware, yeah, sure. 11:22:00  
14 Q. Okay, so cds.cern.ch is affiliated 11:22:02  
15 with the CERN library; is that correct? 11:22:07  
16 MR. DAVIS: Objection; form. 11:22:11  
17 THE WITNESS: I would assume so. I 11:22:12  
18 mean the CERN Document Server means something to 11:22:14  
19 me. The short form, how they code that as a URL, 11:22:16  
20 I do not know. CERN has a rather complicated 11:22:21  
21 document management system which we use. Many, 11:22:24  
22 many complex links between different pages which 11:22:30  
23 are all residing inside this framework. 11:22:33  
24 BY MR. BUROKER: 11:22:40  
25 Q. And I think you said before, but 11:22:40

1 let me just clarify it, who owns the computer 11:22:42  
2 server that provided the content in the '96 11:22:45  
3 timeframe related to the sunshine.cern.ch URL? 11:22:51  
4 MR. DAVIS: Objection; form. 11:22:58  
5 THE WITNESS: To be correct, I cannot 11:23:02  
6 tell. It would be the RD24 project which is 11:23:03  
7 a part of CERN but had its own budget, and how 11:23:07  
8 the exact financial contributions came about I'm 11:23:11  
9 quite sure Dolphin invested something and other 11:23:14  
10 companies did, which is very standard at that 11:23:17  
11 stage in time, even today; CERN has an entire 11:23:20  
12 working group doing this kind stuff. And then 11:23:24  
13 Hans Müller may have decided one or the other way 11:23:27  
14 how funds are being put together in order to pay 11:23:29  
15 this. So that I can't tell after 20 years. 11:23:32  
16 BY MR. BUROKER: 11:23:37  
17 Q. Do you know who had access in 1996 11:23:37  
18 to the sunshine.cern.ch server? 11:23:40  
19 MR. DAVIS: Objection; form. 11:23:43  
20 THE WITNESS: Hans Müller certainly. 11:23:48  
21 I would assume also Hans Bogaerts -- sorry 11:23:49  
22 Andreas Bogaerts -- B-o-g-a-e-r-t-s -- who is 11:23:59  
23 also an author here. These were two jointly 11:23:59  
24 leading the RD24 project. Probably some of the 11:24:07  
25 people who worked at CERN with Hans Müller. I 11:24:10

1 don't remember having access except for these 11:24:12  
2 private web pages, but I can't really give 11:24:16  
3 a complete list. 11:24:20  
4 BY MR. BUROKER: 11:24:20  
5 Q. Okay. So I just want to clarify 11:24:22  
6 that. You do recall visiting the 11:24:24  
7 sunshine.cern.ch:8080 pages? 11:24:27  
8 A. I probably did. 11:24:32  
9 Q. Is it typical in referee 11:24:41  
10 publications to cite to something that's 11:24:49  
11 confidential in your experience? 11:24:50  
12 MR. DAVIS: Objection; form. 11:24:52  
13 THE WITNESS: Not really, because 11:24:58  
14 a citation is there to give a second reference to 11:25:01  
15 back up an argument and if it's confidential and 11:25:04  
16 you cannot use this it would be difficult. 11:25:07  
17 But it can happen that such citations 11:25:16  
18 are being made and certain particular access is 11:25:20  
19 given. So, for example, we have these cases 11:25:24  
20 happening from time to time if there is a PhD 11:25:27  
21 thesis written as a joint project with industry, 11:25:30  
22 and the thesis contains material which is, for 11:25:35  
23 example, subject to a patent just being in the 11:25:38  
24 process of being filed and the thesis is declared 11:25:42  
25 confidential, although a thesis has to be 11:25:45

1 published one can put a certain timeframe on it 11:25:47  
2 saying it will remain unpublished for a certain 11:25:50  
3 time until, for example, all the IP has been 11:25:53  
4 filed and the submission of the thesis is not 11:25:56  
5 damaging any more to the IP. So this "no" has to 11:25:58  
6 be taken with a grain of salt. 11:26:07  
7 (Exhibit No. EMC 1027 was marked for 11:26:07  
8 identification.) 11:26:20  
9 BY MR. BUROKER: 11:26:20  
10 Q. And I believe we're on the same 11:26:20  
11 numbering scheme for both IPRs on the 1000 11:26:21  
12 series, so this is 1027 in both proceedings. 11:26:25  
13 Actually, yeah, we'll just make it 1027 in both 11:26:31  
14 proceedings just to make it easier. 11:26:38  
15 MR. DAVIS: Okay. I'm going to make 11:26:39  
16 some evidentiary objections. It's outside the 11:26:40  
17 scope of direct of institution. I can't tell if 11:26:43  
18 it's incomplete or not. I think it's irrelevant, 11:26:48  
19 may be prejudicial, likely hearsay, lacks 11:26:54  
20 authentication and may contain improper opinion 11:26:58  
21 evidence. 11:27:03  
22 BY MR. BUROKER: 11:27:07  
23 Q. Okay, Dr. Lindenstruth, have you 11:27:07  
24 ever seen this before? 11:27:11  
25 A. I do not remember. 11:27:13

1 Q. Is the Hans Müller the same Hans 11:27:16  
2 Müller we've been talking about? Was he 11:27:19  
3 affiliated with the CERN EP Electronic Design 11:27:21  
4 Group? 11:27:24  
5 A. Well I mean it states so on this 11:27:28  
6 document so I have no reason to doubt that, 11:27:32  
7 although CERN is constantly restructuring. The 11:27:36  
8 EP Group was or is a really large group. It is 11:27:41  
9 well possible that he was a member of that group 11:27:44  
10 at that time. 11:27:46  
11 Q. Do you know what an LHC-B note is? 11:27:48  
12 A. You're referring to the header of 11:27:59  
13 the document LHC-B? 11:28:02  
14 Q. Yes, the header says: 11:28:04  
15 "LHC-B Note 98-030." 11:28:07  
16 So I was asking if you knew what 11:28:11  
17 an LHC-B note is. 11:28:17  
18 A. CERN has four major experiments 11:28:18  
19 for its LHC accelerator, right? One has to 11:28:24  
20 disentangle the accelerator, we call that the 11:28:28  
21 machine, and then the experiments. The physics 11:28:31  
22 is done at the experiments. There are four 11:28:33  
23 experiments: ALICE; ATLAS; CMS; and LHC-B. 11:28:35  
24 LHC-B, an obviously very creative name, was 11:28:47  
25 chosen because LHC studies the weak interaction, 11:28:52

1           which is very important for understanding some of           11:28:59  
2           the fundamental principles of our being here.           11:29:03  
3           The B meson -- m-e-s-o-n -- is a particle which           11:29:09  
4           decays weakly interacting and is extremely rare           11:29:18  
5           and one needs these extremely powerful           11:29:24  
6           accelerators to create them and then LHC-B was           11:29:27  
7           built to basically study the decay of this B           11:29:31  
8           meson. So since it's the LHC-B experiment, then           11:29:35  
9           you see there are variants of noting, the title           11:29:39  
10          says "LHCb" without dash, the note says "LHC-B"           11:29:44  
11          with a dash. I assume this is a note of the           11:29:47  
12          LHC-B experiment with a reference number. If it           11:29:51  
13          was a document for the ALICE experiment, it would           11:29:58  
14          be "ALICE Note" with such a number and so forth.           11:30:00  
15                   Q. Well who are these notes -- what           11:30:03  
16                  are these notes created for?           11:30:05  
17                   MR. DAVIS: Objection; form, outside           11:30:08  
18                  the scope.           11:30:11  
19                   THE WITNESS: Now, yeah, I'm not           11:30:13  
20                  a member of the LHC-B collaboration and I'm           11:30:15  
21                  seeing this for the first time. I can only draw           11:30:18  
22                  a conclusion from my experience how it works in           11:30:22  
23                  ALICE experiment, which is not uncommon.           11:30:25  
24                  Standard procedure is if you wish to make           11:30:30  
25                  a statement to the collaboration -- we're           11:30:33

1 talking, again, this group preparing the 11:30:36  
2 experiment -- saying, "This is the particular way 11:30:40  
3 something could work, this is a suggestion to 11:30:44  
4 solve a particular problem", then normally one 11:30:51  
5 writes up a note, which is basically an internal 11:30:54  
6 paper, which is submitted to that particular 11:30:59  
7 collaboration for review. 11:31:05  
8 Notes are, as far as I know, never 11:31:11  
9 publications, they are used for internal -- they 11:31:14  
10 are made for internal use as a reference to 11:31:15  
11 discuss something particular. 11:31:18  
12 BY MR. BUROKER: 11:31:27  
13 Q. So, if you look at the references 11:31:28  
14 in this document. Reference 6 cites to the RD24 11:31:29  
15 status report 1996, LHCC 96-33 October 1996, and 11:31:40  
16 then it's got the URL [http://sunshine.cern.ch:](http://sunshine.cern.ch:8080/RD24/rd24.html) 11:31:48  
17 8080/RD24/rd24.html. Do you see that? 11:31:59  
18 A. Yeah. 11:32:07  
19 Q. So in 1998, in a note to the 11:32:08  
20 LHC-B, Hans Müller is citing to that 11:32:14  
21 [sunshine.cern.ch:8080](http://sunshine.cern.ch:8080) server reference which 11:32:17  
22 appears to have the RD24 status report from 1996, 11:32:23  
23 correct? 11:32:27  
24 MR. DAVIS: Objection; form. 11:32:28  
25 THE WITNESS: Well it is printed here. 11:32:31

1 More I cannot say about that. 11:32:33

2 BY MR. BUROKER: 11:32:37

3 Q. That doesn't suggest to you -- 11:32:37

4 well, first of all, you have never this document 11:32:38

5 before? 11:32:41

6 A. No, I don't think so. 11:32:42

7 Q. Okay. So you didn't consider this 11:32:44

8 in your declaration when you gave the opinion you 11:32:46

9 thought that the RD24 document was kept 11:32:50

10 confidential, correct? 11:32:53

11 In other words, you didn't have this 11:32:56

12 when you made that determination? 11:32:57

13 A. Your second statement is correct, 11:33:00

14 yes, I didn't have this when I made my 11:33:01

15 declaration. 11:33:05

16 Q. Okay. And reference number 18 in 11:33:05

17 this list of references also says: 11:33:09

18 "Applications of SCI to Data 11:33:12

19 Acquisition at LHC ..." 11:33:21

20 -- which is the same title as 11:33:22

21 Exhibit 1011, the RD24 status report, right? 11:33:25

22 MR. DAVIS: Objection to form. 11:33:28

23 THE WITNESS: Yeah, but I mean this is 11:33:36

24 only referencing the RD24 home page, which is 11:33:37

25 still using this private port number on the 11:33:41



1 website of Hans Müller, yeah. On this sunshine 11:33:47  
2 machine, yeah. 11:33:51  
3 BY MR. BUROKER: 11:33:53  
4 Q. All right, but he's citing to this 11:33:53  
5 port on this URL to a working group that's not 11:33:56  
6 the RD24 working group, he's citing it to the 11:34:02  
7 LHC-B group, correct? 11:34:05  
8 A. Yet another CERN internal working 11:34:10  
9 group, yeah. 11:34:12  
10 Q. So at a minimum he doesn't think 11:34:13  
11 that the document is confidential only to the 11:34:14  
12 RD24 working group? 11:34:17  
13 MR. DAVIS: Objection to form. 11:34:19  
14 BY MR. BUROKER: 11:34:21  
15 Q. Correct? 11:34:21  
16 MR. DAVIS: Calls for improper opinion 11:34:22  
17 evidence. 11:34:24  
18 THE WITNESS: I mean, since you're 11:34:32  
19 referring several times to confidentiality, I 11:34:34  
20 should probably outline why I said that this is 11:34:36  
21 subject to confidentiality. 11:34:41  
22 BY MR. BUROKER: 11:34:43  
23 Q. Your counsel can ask you that 11:34:43  
24 question, I want an answer to my question which 11:34:44  
25 is that this document suggests that at least 11:34:46

1 Mr. Müller didn't believe that the RD24 status 11:34:55  
2 report had to be kept confidential within the 11:34:59  
3 RD24 working group because he cited it to 11:35:00  
4 an outside CERN group. 11:35:04  
5 A. This is a CERN group. 11:35:08  
6 Q. To another CERN group? 11:35:09  
7 MR. DAVIS: Objection; form. And I 11:35:09  
8 maintain my evidentiary objection. 11:35:11  
9 THE WITNESS: Again, it all depends on 11:35:18  
10 the particular confidentiality agreement which 11:35:20  
11 was signed. 11:35:21  
12 BY MR. BUROKER: 11:35:23  
13 Q. I'm just talking about, doesn't 11:35:23  
14 this suggest that at least Dr. Müller -- I said 11:35:25  
15 Mr. Müller it's Dr. Müller -- he has cited the 11:35:29  
16 RD24 status report to a different working group 11:35:32  
17 within CERN, correct? 11:35:36  
18 MR. DAVIS: Objection; form. 11:35:41  
19 THE WITNESS: That document was given 11:35:44  
20 to apparently somebody else, a different group 11:35:49  
21 inside CERN working under possibly the same 11:35:52  
22 confidentiality requirements. 11:35:58  
23 BY MR. BUROKER: 11:36:03  
24 Q. Do you know how many people were 11:36:03  
25 involved in the LHC-B working group in 1996 to 11:36:04

1	1998?	11:36:09
2	A. I do not. I see this document for	11:36:10
3	the first time, I can't tell you.	11:36:12
4	Q. But this is a different question.	11:36:14
5	Do you know, based on your work at CERN, do you	11:36:15
6	know how many people were involved in the LHC-B	11:36:18
7	working group in the '96 to '98 timeframe?	11:36:21
8	A. I mean it would have to be the	11:36:26
9	group focusing at data acquisition and online	11:36:28
10	data selection. I don't know the size of that	11:36:35
11	group. From my experience it would be a rather	11:36:39
12	small group, handful of people. But this is	11:36:43
13	a guess and I don't wish to raise guesses here,	11:36:47
14	so I can't give you a clear answer as how many	11:36:50
15	people have been involved here, but we're not	11:36:54
16	talking huge collaborations.	11:36:56
17	Q. Do you know if Dr. Müller was	11:37:00
18	involved in both RD24 and the LHC-B working	11:37:01
19	groups?	11:37:09
20	A. I mean, in general, these RD	11:37:09
21	projects were not there to work for any	11:37:12
22	particular experiment, they were there to solve	11:37:16
23	generic problems for basically the entire LHC	11:37:18
24	project. This is why they're called RD and not	11:37:22
25	experiment A, B, C, D, right? And so it was well	11:37:25

1           within his obligations to, let's say, market the           11:37:29  
2           technology to possibly interested other groups           11:37:34  
3           helping them to solve their particular computing           11:37:39  
4           problems. So apparently he's trying to address           11:37:42  
5           an issue which is particular for the LHC-B           11:37:50  
6           experiment, showing a potential solution. But           11:37:56  
7           without referring to this document in depth --           11:38:00  
8           and I would have to read it carefully, we're           11:38:03  
9           talking some 19 pages -- I can't tell more.           11:38:05  
10          (Brief pause to re-establish realtime connections.)   11:39:39  
11          BY MR. BUROKER:           11:39:39  
12                   Q.    Dr. Lindenstruth, I want to turn           11:39:40  
13           you to page 8 and paragraph 20 of your '814           11:39:40  
14           declaration.           11:39:45  
15                   So the first sentence says you           11:39:57  
16           understand that in Inter Partes Review, the claim           11:40:00  
17           terms are to be given their broadest reasonable           11:40:03  
18           interpretation in light of the specification,           11:40:06  
19           correct?           11:40:08  
20                   A.    Yeah.           11:40:09  
21                   Q.    And that's your understanding --           11:40:09  
22                   A.    Yeah.           11:40:12  
23                   Q.    -- provided by counsel, correct?           11:40:12  
24                   A.    (The witness nodded.)           11:40:14  
25                   Q.    You have to say "yes" or "no", so           11:40:16

1 she can have an answer. 11:40:19

2 A. Yes. 11:40:20

3 Q. Or some audible response. Okay. 11:40:21

4 I think there we might have identified 11:40:27

5 one of those typos and I just want to clarify 11:40:30

6 that. 11:40:32

7 So the next sentence say: 11:40:32

8 "In performing my analysis and 11:40:34

9 rendering my opinions, where the Board of 11:40:36

10 Acqis ...". 11:40:38

11 -- I think that should be "or Acqis" 11:40:39

12 but you tell me -- 11:40:43

13 "... has proposed a construction of the 11:40:44

14 BRI of a claim term, I have applied that 11:40:59

15 construction in my analysis." 11:40:49

16 Should that be "Board or Acqis"? 11:40:50

17 A. Well, for all the broadest 11:41:01

18 reasonable interpretation cases and further I 11:41:02

19 have referred to the Board. So in my 11:41:04

20 understanding this is the Board for this Acqis 11:41:06

21 case, and not written -- 11:41:07

22 Q. Oh, is that what you meant? Okay. 11:41:10

23 It wasn't clear whether you meant the Board 11:41:13

24 meaning like Board of Directors of Acqis or you 11:41:15

25 meant Board of Patent Appeals or Acqis. So 11:41:17

what's your --

A. No, I've referred, I mean, to what the Board has said in some of the cases which are discussed further, right? It's either the decision of the Board or what I would consider, as an expert in this field, to be the broadest reasonable interpretation.

the Board has said in some of the cases which are

discussed further, right? It's either the

decision of the Board or what I would consider,

as an expert in this field, to be the broadest

reasonable interpretation.

Q. But I believe there are some

instances in which Acqis has proposed a broadcast

reasonable interpretation.

A. Inside the patent, yes.

Q. Correct. And you used Acqis's

proposed broadest reasonable interpretation in

a few instances as well, correct?

A. If as set forth inside the patent

documents, correct.

Q. What patent documents are you

talking about? Just so we're on the same page.

Do you mean in the patents themselves?

A. Yeah, as we refer here to the '814

then it would have to be the '814 document,

you're right.

Q. Okay, I just want to make sure I

understand so we're clear for the record, because

there's different patent documents: there's the

1 patent, there's the file history. Just so we're 11:42:28  
2 clear I may ask you to clarify what we're talking 11:42:30  
3 about, okay? 11:42:32  
4 And then it says: 11:42:33  
5 "Otherwise, I have interpreted claim 11:42:41  
6 terms by giving them the ordinary meaning that 11:42:42  
7 they would have to a [person of skill in the 11:42:46  
8 art], reading the '814 patent with its priority 11:42:48  
9 filing date (October 30, 1998) in mind, and in 11:42:53  
10 light of its specification and file history." 11:42:57  
11 Do you see that? 11:43:03  
12 A. I see that, yes. 11:43:03  
13 Q. So just to be clear, if the Board 11:43:04  
14 gave an interpretation of what it found to be the 11:43:07  
15 broadest reasonable interpretation, you applied 11:43:10  
16 the Board's interpretation correct? 11:43:12  
17 A. Correct. 11:43:14  
18 Q. If you don't have a Board 11:43:15  
19 interpretation then you used the ordinary meaning 11:43:16  
20 of the term or the broadest reasonable 11:43:20  
21 interpretation of the remaining terms? 11:43:24  
22 MR. DAVIS: Objection to form. 11:43:28  
23 BY MR. BUROKER: 11:43:30  
24 Q. Or do you think they mean the same 11:43:31  
25 thing? The ordinary meaning means the same thing 11:43:32

1 as broadest reasonable interpretation? 11:43:34

2 MR. DAVIS: Objection to form. 11:43:36

3 THE WITNESS: The broadest reasonable 11:43:40

4 interpretation in light of the specification. 11:43:45

5 This is what I used. 11:43:46

6 BY MR. BUROKER: 11:43:48

7 Q. So where it says "ordinary 11:43:48

8 meaning" what you meant is the broadest 11:43:49

9 reasonable interpretation in light of the 11:43:53

10 specification of the term? 11:43:53

11 A. It's my understanding this is what 11:43:56

12 I'm supposed to do. 11:43:57

13 Q. All right, it wasn't clear and 11:43:59

14 that's why I wanted to ask that question. 11:44:00

15 THE WITNESS: I would like to go to the 11:44:04

16 bathroom one more time. 11:44:06

17 MR. BUROKER: The bathroom again? 11:44:08

18 Sure. 11:44:09

19 THE WITNESS: Yes, it's almost 12:00 11:44:10

20 now. 11:44:12

21 MR. BUROKER: Yes, let's go off the 11:44:13

22 record. 11:44:14

23 (Brief recess taken 11:44 a.m. - 11:51 a.m.) 11:51:49

24 BY MR. BUROKER: 11:51:49

25 Q. So, turning then to paragraph 114. 11:51:53



1                   MR. DAVIS: Just to be clear we're                   11:52:04  
2                   still on the '814.                   11:52:05

3                   MR. BUROKER: Yeah, I'm using that as                   11:52:08  
4                   the primary document. I know that they're very                   11:52:09  
5                   similar.                   11:52:12

6                   BY MR. BUROKER:                   11:52:17

7                   Q. So actually I was going to                   11:52:12  
8                   paragraph 113, sorry.                   11:52:15

9                   So in Section VII, "Claim Construction",                   11:52:17  
10                  you set forth your discussion of three terms that                   11:52:21  
11                  you specifically identified as providing                   11:52:29  
12                  construction for; is that correct?                   11:52:37

13                  A. Yeah, this is correct.                   11:52:37

14                  Q. And that's the "peripheral                   11:52:39  
15                  component interconnect (PCI) bus transaction"                   11:52:41  
16                  term, the "encoded" term and then the "extending                   11:52:42  
17                  from" term, correct?                   11:52:45

18                  A. This is correct.                   11:52:46

19                  Q. Okay. For the "PCI bus                   11:52:47  
20                  transaction" term, if I use that phrase you'll                   11:52:54  
21                  know which one I'm referring to rather than                   11:52:56  
22                  repeating the whole thing, right? So I'll just                   11:53:01  
23                  say "PCI bus transaction".                   11:53:03

24                  A. (The witness nodded.)                   11:53:04

25                  Q. Okay. So for the "PCI bus                   11:53:06

1 transaction" term, you say that: 11:53:09

2 "... [the] Board construed the terms to 11:53:12

3 mean 'Peripheral Component Interconnect ... 11:53:15

4 industry standard bus transaction." 11:53:20

5 Correct? 11:53:21

6 A. Yeah. 11:53:22

7 Q. So that's the interpretation you 11:53:22

8 used as the broadest reasonable interpretation? 11:53:24

9 A. Uh-huh, yes. 11:53:27

10 Q. But then you provide some 11:53:28

11 additional thoughts on what that means in 11:53:31

12 paragraph 114, right? 11:53:34

13 A. Yeah, it seemed important. 11:53:49

14 Q. Okay. So you say that a PCI bus 11:53:51

15 transaction must include the PCI address and bus 11:54:11

16 command information during the address phase and 11:54:20

17 the PCI data byte enables during the data phase. 11:54:23

18 Is that your understanding? 11:54:27

19 A. Amongst other things, yes. 11:54:30

20 Although I just don't see it where I wrote this 11:54:32

21 in detail. 11:54:37

22 Q. Well let me look for it, too. Oh 11:54:38

23 here it is. So the second line on page 77 after 11:54:54

24 the semicolon, you say: 11:54:56

25 "... they require the address and data 11:55:01

1 phases of a PCI bus transaction, which includes 11:55:03  
2 the PCI address and bus command information 11:55:06  
3 during the address phase ...". 11:55:09  
4 And then you cite to the PCI spec and 11:55:11  
5 then you say: 11:55:14  
6 "... and the PCI data and byte enables 11:55:15  
7 during the data phases." 11:55:17  
8 Do you see that? 11:55:19  
9 A. That is correct, yeah, yeah. 11:55:20  
10 Q. When you say "they", you are 11:55:22  
11 referring to the claims? You can read the whole 11:55:26  
12 sentence but I'm trying to understand what you 11:55:30  
13 mean when you say "they require". 11:55:32  
14 A. In the claims discuss 11:55:40  
15 communicating PCI transactions, so the claims do 11:55:42  
16 not require the PCI bus transactions occur on 11:55:50  
17 a PCI bus, they require the address and data 11:55:53  
18 phases and so forth. So the "they" in this 11:55:56  
19 context refers to the claims to make clear that 11:56:01  
20 what PCI bus transaction really has to include. 11:56:06  
21 Q. So is it your understanding that 11:56:14  
22 you need to communicate the PCI address and bus 11:56:20  
23 command information during an address phase and a 11:56:25  
24 PCI data and byte enables during the data phase 11:56:28  
25 to have communicated a PCI bus transaction? 11:56:33

1                   A.    Yes.  If you would leave any of                   11:56:37  
2                   those out it cannot work.  For example, if you               11:56:41  
3                   leave the command out, the target being addressed               11:56:45  
4                   wouldn't know where the read is or the write is               11:56:49  
5                   or the configuration and so forth, that has to be               11:56:51  
6                   there.  And there is even more context which is               11:56:55  
7                   set forth in the PCI specification, which has to               11:56:59  
8                   be there for a PCI transaction to function.               11:57:03  
9                   Q.    Okay.  I'm just trying to                   11:57:07  
10                  understand.  That's the understanding of the term           11:57:08  
11                  "PCI bus transaction" that you used in analyzing           11:57:15  
12                  the claims as compared to the prior art that was           11:57:20  
13                  asserted in these IPRs, correct?                   11:57:23  
14                  A.    Yeah.                                   11:57:27  
15                  Q.    So let's look at the claims.  So                   11:57:27  
16                  that's the '814 patent which is the 1001 from the           11:57:45  
17                  '1469 IPR.  And then I'll give you the '873               11:57:55  
18                  Patent which is 1001 from the '1462 IPR.               11:58:01  
19                  THE WITNESS:  Oops they have the same               11:58:09  
20                  reference number.                           11:58:11  
21                  BY MR. BUROKER:                           11:58:11  
22                  Q.    Right, they do, because of the                   11:58:12  
23                  weird way in which the PTO PTAB procedures               11:58:13  
24                  require that we number exhibits.  So rather than           11:58:15  
25                  use the exhibit number, if we just talk about               11:58:19

1	which patent you're looking at.	11:58:21
2	So looking at the '814 Patent, claim 24,	11:58:24
3	let's start down with the element that says,	11:58:45
4	"a second LVDS channel". Do you see that one?	11:58:52
5	It's the sixth or seventh one down.	11:58:55
6	A. Yeah.	11:58:55
7	Q. Okay, so one of the elements of	11:58:59
8	the claim talks about:	11:58:59
9	"A second LVDS channel comprising two	11:59:00
10	unidirectional serial channels that transmit data	11:59:05
11	in opposite directions, said second LVDS channel	11:59:07
12	extending from said north bridge ..."	11:59:13
13	-- and it says:	11:59:16
14	"... to convey said address and data	11:59:16
15	bits of PCI bus transaction in serial form."	11:59:20
16	Do you see that?	11:59:25
17	A. I see that.	11:59:29
18	Q. And then up in the northbridge	11:59:29
19	limitation, a couple of limitations up, it says:	11:59:31
20	"A north bridge to communicate address	11:59:33
21	and data bits of PCI bus transaction in serial	11:59:36
22	form ..."	11:59:40
23	Do you see that?	11:59:40
24	A. Ah, here we are, yes.	11:59:46
25	Q. Okay. So in both of those	11:59:49

1 limitations there's this phrase "address and data 11:59:51  
2 bits of PCI bus transaction in serial form". 11:59:55

3 A. Uh-huh. 12:00:01

4 Q. Right? 12:00:02

5 A. Yes. 12:00:02

6 Q. So you agree that that phrase uses 12:00:03  
7 the singular form of the word "transaction", 12:00:10  
8 correct? 12:00:14

9 A. Yes. 12:00:24

10 Q. So it doesn't say "transactions", 12:00:25  
11 it just says "transaction", correct? 12:00:27

12 A. It says that, yeah. 12:00:31

13 Q. Okay. So that would cover 12:00:32  
14 a situation in which a single transaction is 12:00:36  
15 communicated, right? 12:00:42

16 A. Well, I mean, in any particular 12:00:45  
17 case only one PCI transaction can occur at any 12:00:47  
18 point in time. It's a bus. 12:00:51

19 Q. But the claim doesn't require that 12:00:54  
20 the northbridge communicate multiple bus 12:00:56  
21 transactions, it just has to, at any point in 12:01:01  
22 time, communicate one to meet this claim, right? 12:01:04

23 MR. DAVIS: Objection to form. 12:01:08

24 THE WITNESS: The PCI specification 12:01:10  
25 lays out how a PCI transaction has to work, and 12:01:14

1 according to the specification at any point in 12:01:19  
2 time there is one PCI transaction ongoing on the 12:01:21  
3 bus. 12:01:23  
4 BY MR. BUROKER: 12:01:24  
5 Q. Right, and I'm asking you 12:01:25  
6 a question more about how you read these claims. 12:01:26  
7 So claim 24 is a method claim. It's your 12:01:28  
8 understanding that a method claim understands 12:01:34  
9 multiple steps that are performed, right? 12:01:36  
10 A. Uh-huh. 12:01:38  
11 Q. Okay. And one of those steps is 12:01:38  
12 inserting an attached computer module into the 12:01:48  
13 bay of a console and then the rest of this claim 12:01:52  
14 -- not the rest but a lot of the other elements 12:01:56  
15 then specify what is inside the ACM, the attached 12:01:58  
16 computer module, right? 12:02:04  
17 A. Uh-huh. 12:02:05  
18 Q. And that's, you know, the 12:02:06  
19 microprocessor, northbridge, main memory and 12:02:08  
20 second LVDS channel are part of the ACM. Is that 12:02:11  
21 the right way you read this claim? 12:02:16  
22 MR. DAVIS: Objection to form. 12:02:18  
23 THE WITNESS: "Modular computing  
24 system, the console comprising a first ... LVDS  
25 signal -- differential signal channel comprising

1 two unidirectional serial channels that transmit  
2 encoded data of ... PCI -- Component Interconnect  
3 bus transaction in opposite directions."

4 Yes, this is what it says. It goes on: 12:02:41

5 "A microprocessor unit coupled to a 12:02:41  
6 mass memory storage device; 12:02:41  
7 A north bridge to communicate address 12:02:47  
8 and data bits." 12:02:48

9 This is the claim. 12:02:49

10 BY MR. BUROKER: 12:02:49

11 Q. Right. But the way this claim is 12:02:52  
12 structured, just so we are on the same page, is 12:02:54  
13 that the microprocessor, northbridge, main memory 12:02:56  
14 and second LVDS channel are defined what has to 12:03:00  
15 be part of the ACM, correct? 12:03:07

16 MR. DAVIS: Objection to form. 12:03:10

17 THE WITNESS: The ACM comprises 12:03:13  
18 a microprocessor coupled to a mass storage 12:03:16  
19 device, the northbridge, communicating the data 12:03:18  
20 bits in serial form, comprises a main memory, 12:03:22  
21 coupled to the microprocessor unit through the 12:03:27  
22 northbridge and the second LVDS channel. Yeah. 12:03:30

23 BY MR. BUROKER: 12:03:30

24 Q. Right, okay. So the northbridge 12:03:34  
25 part of the ACM has to communicate address and 12:03:41



1 data bits of PCI bus transaction in serial form, 12:03:47  
2 right? 12:03:51  
3 A. Yeah. 12:03:54  
4 Q. It doesn't say that it has to 12:03:54  
5 communicate multiple PCI bus transactions in 12:03:56  
6 serial form, it can but it doesn't have to do 12:03:59  
7 multiple ones. Is that your understanding of how 12:04:03  
8 to read this claim? 12:04:05  
9 A. I don't understand the 12:04:08  
10 differentiation you're trying to make here. If 12:04:09  
11 the northbridge is capable of performing a PCI 12:04:16  
12 transaction, a PCI is a defined standard. In 12:04:19  
13 order to be compliant with that standard it has 12:04:24  
14 to be capable of performing all the functionality 12:04:28  
15 set forth by the standard or it would be 12:04:30  
16 incompatible and it would not be allowed to use 12:04:32  
17 the term. So that means, of course, one cannot 12:04:35  
18 limit this claim to saying if there is one single 12:04:38  
19 particular PCI transaction executed or capable of 12:04:41  
20 -- if the northbridge is capable of doing just 12:04:46  
21 one particular transaction and not the features 12:04:48  
22 as defined by PCI, that would not be a correct 12:04:54  
23 interpretation. So this is why I'm a little 12:04:59  
24 confused why you're trying to disentangle between 12:05:01  
25 singular and plural here. 12:05:04

1                   Q.    So that's the way you read this                   12:05:07  
2                   northbridge limitation, the way you've just               12:05:08  
3                   explained it then?                                       12:05:11  
4                   A.    (The witness nodded.)                               12:05:13  
5                   Q.    Okay. Now, the claim says that                   12:05:14  
6                   you have to communicate address and data bits.           12:05:17  
7                   You would agree with me that it doesn't mention           12:05:22  
8                   command information, correct?                               12:05:25  
9                   MR. DAVIS: Objection to form.                           12:05:28  
10                  THE WITNESS: It says:                                   12:05:31  
11                  "... address and data bits of PCI                       12:05:34  
12                  transaction in serial form ..."                           12:05:37  
13                  It doesn't say explicitly the other                       12:05:38  
14                  corollary information which is needed to define           12:05:41  
15                  a PCI transaction, but it says "PCI transaction".       12:05:44  
16                  So without, for instance, the additional                   12:05:48  
17                  functionality, it wouldn't be a PCI transaction.       12:05:55  
18                  BY MR. BUROKER:   12:06:10  
19                  Q.    So even though the word "command                   12:06:10  
20                  information" is not expressly present, it's your           12:06:12  
21                  reading of this claim that the northbridge must           12:06:15  
22                  communicate PCI bus command information in serial       12:06:20  
23                  form as well; is that correct?                           12:06:24  
24                  A.    If you read this patent you will                   12:06:28  
25                  find that this context is defined as such. It is       12:06:30

1	about a PCI transaction.	12:06:34
2	Q. Okay. The claim also doesn't	12:06:35
3	expressly require transmission or communication	12:06:40
4	of what you call byte enables either, does it?	12:06:43
5	A. It doesn't explicitly state, yes.	12:06:49
6	Q. But, again, it's your	12:06:52
7	understanding that to meet this claim the	12:06:53
8	northbridge must communicate byte enables from	12:06:57
9	a PCI bus transaction, correct?	12:07:03
10	MR. DAVIS: Objection; form.	12:07:05
11	THE WITNESS: There is signals on the	12:07:08
12	PCI bus, data bus signals, which are invalid	12:07:10
13	because of byte enables being set to invalid. So	12:07:14
14	this has to be encoded in some form, otherwise	12:07:20
15	the data, again, has no meaning.	12:07:23
16	BY MR. BUROKER:	12:07:27
17	Q. And the phrasing here also doesn't	12:07:28
18	say that you have to communicate all of the	12:07:32
19	address and data bits of a PCI bus transaction.	12:07:36
20	Do you agree?	12:07:41
21	A. It doesn't explicitly say that,	12:07:43
22	but, again, if I give you a telephone number but	12:07:47
23	leave out two digits, what relevance does it	12:07:53
24	have?	12:07:58
25	Q. Right. So, in your view, if the	12:08:00

1 northbridge did not communicate all of the 12:08:04  
2 address and data bits and all of the command 12:08:07  
3 information and byte enables of a PCI bus 12:08:09  
4 transaction in serial form, you would believe 12:08:14  
5 that that northbridge doesn't meet this claim 12:08:17  
6 limitation; is that correct? 12:08:20  
7 A. It wouldn't be a PCI bus 12:08:21  
8 transaction. 12:08:23  
9 Q. Well, the question is: if the 12:08:23  
10 northbridge didn't communicate all of the address 12:08:26  
11 and data bits and all of the bus command 12:08:30  
12 information and byte enables but only 12:08:33  
13 communicated some of those bits, in your view it 12:08:36  
14 wouldn't meet this claim's requirement, right? 12:08:39  
15 A. I believe that's correct, yeah. 12:08:43  
16 Q. And you say you're getting that 12:08:45  
17 from reading the specification. Do you cite 12:08:51  
18 anywhere in this explanation where the 12:08:59  
19 specification dictates that or is it from the PCI 12:09:01  
20 specification alone? Let me strike that because 12:09:06  
21 the word "specification" is confusing. 12:09:10  
22 Are you getting that from the 12:09:12  
23 requirements of the PCI specification or the 12:09:14  
24 patent specification or both? 12:09:17  
25 MR. DAVIS: Objection; form. 12:09:22

1 THE WITNESS: First, this is in the 12:09:25  
2 context of a PCI bus transaction and this is well 12:09:27  
3 defined, if you leave something out, remove 12:09:31  
4 something, then it is not, again, according to 12:09:33  
5 the specification, it wouldn't function and also 12:09:37  
6 looking at the problem the patent solves would 12:09:43  
7 require this information to be there. 12:09:48  
8 BY MR. BUROKER: 12:09:50  
9 Q. Okay, let me give you then, just 12:09:51  
10 in case you need it, the ... 12:09:52  
11 A. The PCI local bus specification 12:09:58  
12 2.1. 12:09:58  
13 BY MR. BUROKER: 12:10:00  
14 Q. This is Exhibit 2001, I'm not sure 12:10:00  
15 if it's in both or which of the -- it's 2001 in 12:10:03  
16 one of the two IPR proceedings. 12:10:08  
17 MR. DAVIS: I think it's in both, but 12:10:10  
18 I'm not positive on that. 12:10:12  
19 BY MR. BUROKER: 12:10:14  
20 Q. Okay, I think so too. 12:10:15  
21 But anyway you've seen this before 12:10:16  
22 obviously. 12:10:21  
23 A. Yeah. 12:10:22  
24 Q. Okay. And this is PCI Spec Rev 12:10:22  
25 2.1 that's referred to in your declaration 12:10:26

1 paragraph 114; is that right? 12:10:29

2 A. 114 I have to verify but, yes, 12:10:33

3 it's certainly being referenced. 12:10:36

4 Q. Sorry, you have multiple documents 12:10:36

5 open at once. Do you have that? 12:10:36

6 A. Yeah. And I believe there is some 12:10:45

7 language about what is the correct version of the 12:10:49

8 PCI local bus specification because this thing 12:10:52

9 has been a little bit iterative. The 2.2 I 12:10:58

10 believe was followed around '99/2000, I don't 12:11:03

11 remember exactly. Although the changes, the 12:11:06

12 differences between 2.1 and 2.2 are minor and not 12:11:09

13 relevant here, but just to be correct. I think 12:11:12

14 it's on page 30. 12:11:15

15 Q. And so you're -- oh, go ahead, 12:11:22

16 you're still answering. 12:11:25

17 A. 2.1 is the relevant one being 12:11:42

18 valid at the time. 12:11:46

19 Q. Right. So in paragraph 114 you 12:11:47

20 cite to page 30 of this PCI specification 12:11:49

21 Exhibit 2001. So can you point me to which 12:12:00

22 particular portion of page 32 you were -- 12:12:06

23 A. 30 or 32? 12:12:09

24 Q. It says 32 in your declaration. 12:12:10

25 A. I'm just trying to find the 12:12:43

1 context so it is clear. 12:12:44

2 Q. And if it's meant to be 12:12:46

3 a different page we can correct it, that's one of 12:12:47

4 the reasons I asked that question. I'm not sure 12:12:49

5 that that's -- anyway, I'll let you testify. 12:12:50

6 My question is which portion of the PCI 12:12:52

7 Spec Revision 2.1 supports your view that the 12:12:54

8 claims require the address and data phases of the 12:13:01

9 PCI bus transaction which include the PCI address 12:13:05

10 and bus command information during the address 12:13:07

11 phase and the PCI data and byte enables during 12:13:10

12 the data phases? 12:13:13

13 A. I mean these references are meant 12:13:15

14 to be examples in any case because when we're 12:13:16

15 talking about a PCI, then this is what it is, 12:13:21

16 right? Like, with every interface document or 12:13:23

17 standard -- this is a de facto standard -- if you 12:13:29

18 violate parts of it you don't have a standard 12:13:34

19 anymore and it doesn't work anymore because the 12:13:37

20 reason for this is to enable different devices to 12:13:39

21 communicate. 12:13:42

22 Now, this reference here is about the 12:13:43

23 requirement that there is address and command 12:13:44

24 information during the address phase at 32. So 12:13:47

25 let me just see, this is a long page of text it 12:13:51

1 must be in here. Let me look this up. 12:13:54

2 No, this is all transaction language. 12:14:27

3 I can't find it right now. Which is really 12:14:54

4 strange because we went over the references to be 12:14:57

5 correct, quite a few times. 12:15:02

6 Q. I just double checked, you also 12:15:10

7 cite the page 32 in the declaration for the '873 12:15:13

8 Patent. 12:15:18

9 A. Then it would be just consistent. 12:15:18

10 Q. So that's why if you need to take 12:15:21

11 your time to find it, you know, I wanted to make 12:15:24

12 sure we understood what you're referring to when 12:15:27

13 you cite to the address and bus command 12:15:32

14 information during the address phase and the PCI 12:15:40

15 data and byte enables during the data phase. So 12:15:45

16 if you need to take time to -- 12:15:48

17 A. I mean I found a few places where 12:15:48

18 that is already quite obvious, but now I'm trying 12:15:50

19 to see anywhere near page 32 because the 12:15:53

20 references should be right. 12:16:01

21 This is all about transaction ordering 12:16:46

22 which is at a higher level of bus protocol. 12:16:48

23 I would like to review this but I can give you 12:17:00

24 here another example where this is very clearly 12:17:05

25 stated, so that you have it. 12:17:09



1 Q. Where are you looking at? 12:17:10

2 A. It may not be the best example for 12:17:12

3 a citation. Page 36, which is an example of 12:17:13

4 a read transaction, 37 a write transaction. And 12:17:19

5 there you see basically the major required 12:17:26

6 functionality and signals referring to 12:17:30

7 Figure 3-1, Basic Read Operation. A PCI 12:17:40

8 transaction is always initiated by the first 12:17:43

9 clock state with frame being low, the upper 12:17:47

10 signal trace. And I should say PCI is what is 12:17:52

11 called a synchronous bus, all signals are with -- 12:17:55

12 Q. Can you say that again? I didn't 12:17:58

13 understand it. A what? 12:17:59

14 A. Synchronous bus. 12:18:04

15 Q. Synchronous bus, okay. My 12:18:06

16 apologies, you said it just fine, I just couldn't 12:18:06

17 pick it up. A synchronous bus, okay. 12:18:08

18 A. As compared to an asynchronous bus 12:18:10

19 which is VME. 12:18:15

20 That means basically only the signal 12:18:15

21 level -- we like to call it state -- at the 12:18:19

22 rising edge of the clock signal is relevant; 12:18:21

23 anything in between doesn't matter. Which means 12:18:25

24 you can basically take the bus state wherever 12:18:28

25 these dashed lines are or dotted lines are, the 12:18:32

1 vertical lines, and say this is a state. So 12:18:35  
2 state number 1, clock number 2, frame low, always 12:18:39  
3 defines the beginning of the transaction. And 12:18:44  
4 the first clock of every PCI transaction has to 12:18:47  
5 be the address and command. And you see that 12:18:51  
6 with "AD" labeled as "address". PCI is to save 12:18:54  
7 pins, what is called a multiplexed address data 12:19:02  
8 bus, meaning it uses the same signal pins for 12:19:07  
9 address and data information, depending on the 12:19:11  
10 state of the bus. So, basically -- and, I mean, 12:19:14  
11 this is obvious to do it like that, the first 12:19:18  
12 clock says, "What does the master want to do and 12:19:21  
13 where? Where is the address? What is the 12:19:25  
14 command?" 12:19:27  
15 I will skip the initiator and target 12:19:29  
16 ready signals because they're only for flow 12:19:33  
17 control. 12:19:35  
18 The device selected signal is there to 12:19:36  
19 enable the selected device to say, "I'm there". 12:19:38  
20 The reason being it may take a long time for 12:19:46  
21 a device to answer and the bus master has to be 12:19:48  
22 able to disentangle the slow device from a not 12:19:52  
23 existing device, which is important in case of 12:19:57  
24 the automatic configuration functionality, these 12:19:58  
25 whole configuration cycles. 12:20:02

1                   The bus commands are nicely outlined,                   12:20:03  
2                   and this figure I even posted in my deposition.               12:20:05  
3                   It's -- now, where are we -- also here in the               12:20:13  
4                   specification, of course, which is page -- I just           12:20:16  
5                   saw it. Here we are, page 21, right? It's               12:20:29  
6                   a 4-bit field, so you have 16 commands, all 16,           12:20:37  
7                   or mostly all 16 are defined, which gives you the       12:20:43  
8                   set of transactions available.                   12:20:49  
9                   After the address phase, as it's been                   12:20:52  
10                  called, there is an arbitrary number of data               12:20:55  
11                  phases, the length is only limited by some               12:20:59  
12                  environmental configuration, which is not               12:21:03  
13                  specified here, a PCI transaction must not exceed       12:21:06  
14                  a certain length so that nobody can block the bus       12:21:09  
15                  for too long. And then every time target and           12:21:12  
16                  initiator simultaneously say "I'm ready", data is       12:21:16  
17                  exchanged, as you can see from this diagram.           12:21:20  
18                  And that is valid for basically every                   12:21:22  
19                  transaction although they have different meanings       12:21:25  
20                  and different flavors. So a configuration               12:21:27  
21                  transaction still would have the appropriate           12:21:30  
22                  command byte enables but a couple of details           12:21:32  
23                  would be different. And, for instance, if there       12:21:35  
24                  is a read multiple, these cache line type               12:21:39  
25                  transactions, then there is an indication as to       12:21:43

how many words are exchanged and so forth.

But this is basically the context which needs to be there for a PCI transaction to be complete. Write transaction is same thing, except -- and this is why these are different diagrams -- the data flow is different. We can see nicely from Figure 3-2 that the address phase is immediately followed by a data phase, which is obviously making sense because if somebody wants to write, this is then the master. The initiator, as it's called in PCI, would have to have the data to write otherwise it wouldn't want to write, so it can submit the data immediately on to the bus.

In case of a read transaction, the target would have to notice, "Ah, I'm the one being addressed", but then it has to access its local resources to find that data to respond to which is obviously not going to happen within a clock. It cannot be. And there is an additional requirement, there is a minimum of one clock which is shown by these nice little arrows here, which is called a bus turnaround cycle, because here we have first the master driving the bus, then data comes back to the master, so the master

has to release the bus, and the slave, the	12:22:55
responding device, has to drive the data signals	12:22:57
now. And in order to avoid race conditions where	12:23:00
both drive simultaneously, which is electrically	12:23:05
really bad, basically a short circuit, there is	12:23:10
this turnaround cycle.	12:23:11

Q. Okay, yeah, that was a lot of testimony there, so just so we break it down a little bit.

So you get the idea that you have to	12:23:19
have address and data phase and the address phase	12:23:21
has to include the address and bus command and	12:23:28
the data phase has to include the data and byte	12:23:31
enables from reading the specification as	12:23:32
a whole, in particular looking at the command	12:23:36
definitions, and then the explanation of how each	12:23:41
transaction works in this specification, right?	12:23:44

A. Yeah, and I think we should  
probably see whether we can find a nicer  
reference here because I couldn't find it, or if  
I overlooked something I can point you to it  
tomorrow.

Q. It's more of a summary rather than  
a whole bunch of pages to read through?

A. Yeah, but, again, it's a standard. 12:24:02

1           So unfortunately these standards tend to be long           12:24:07  
2           and bulky.           12:24:10

3                   Q.    So let me ask you something else           12:24:11  
4           about what you did when you were looking at this.       12:24:13  
5           If the northbridge is able to send this           12:24:17  
6           information about any of these transactions, you       12:24:22  
7           said there were 16, is that all that's necessary       12:24:26  
8           in your mind or does this claim require that the       12:24:29  
9           northbridge be able to communicate the address       12:24:33  
10          and data phases of all of the different types of       12:24:37  
11          PCI bus transactions laid out in this PCI           12:24:40  
12          specification?           12:24:42

13                   A.    And which part of the document are       12:24:45  
14          we now looking at, just to be clear?           12:24:47

15                   Q.    Which document? The declaration?       12:24:49  
16          Same paragraph, 114, you say:           12:24:52  
17                   "[The claims] require the address and       12:24:55  
18          data phases of a PCI bus transaction."           12:24:58

19                   So can that be any of the 16 PCI bus       12:25:02  
20          transactions or does it require that you be able       12:25:06  
21          to do that for all 16?           12:25:08

22                   A.    Yes. For example --           12:25:11

23                   Q.    So that what --           12:25:15

24                   A.    -- if you do away with the PCI       12:25:17  
25          configuration you will never get to a normal       12:25:19

1 memory read or write because you can't configure 12:25:24  
2 the system and it's useless. So you have to be 12:25:26  
3 able to -- a few of them are optional, but those 12:25:30  
4 required -- and these are configuration I/O on 12:25:34  
5 memory read and write -- they have to be there 12:25:38  
6 for the system to function. 12:25:41

7 Q. So which ones are mandatory? 12:25:43

8 A. Certainly configuration, memory 12:25:50  
9 read and write. I believe also I/O. It's stated 12:25:53  
10 in here somewhere. I believe that dual address 12:25:57  
11 cycle is optional and only required in systems 12:26:17  
12 which do 64-bit addressing in a 32-bit system. 12:26:07  
13 Most of them are required. 12:26:13

14 Q. Memory read and memory write 12:26:18  
15 required, right? 12:26:20

16 A. Certainly. 12:26:21

17 Q. And then you say configuration 12:26:22  
18 read and configuration read are required? 12:26:24

19 A. Absolutely essential. These are 12:26:27  
20 the first transactions ever done in PCI, 12:26:29  
21 otherwise it won't work. 12:26:31

22 Q. What about the very first one, 12:26:32  
23 interrupt acknowledge? 12:26:35

24 A. An I/O, an external device without 12:26:39  
25 interrupt, will require the CPU to pull the 12:26:43

1 device, which is highly inefficient, so required. 12:26:45

2 Q. Yes, what's special cycle? 12:26:48

3 A. That I'm not sure at the moment. 12:26:54

4 Let me have a quick look. Possibly required, 12:26:56

5 possibly not; that I don't know off the top of my 12:27:00

6 head. There is a list of transactions being 12:27:02

7 outlined in here and this should also say. I 12:27:07

8 don't remember ever using it, 372, I've designed 12:27:33

9 so many pieces to play with myself. This is 12:27:45

10 a broadcast command. It doesn't say that it is 12:28:02

11 optional, so it is required. At least I don't 12:28:07

12 see that it claims it to be optional. 12:28:11

13 Q. And then there's a bunch of 12:28:15

14 reserved ones. But then you skip down to 1100 12:28:16

15 memory read multiple, is that required or 12:28:22

16 optional? 12:28:25

17 A. It's not saying optional, so it's 12:28:40

18 mandatory. 12:28:42

19 Q. And then you say dual address 12:28:43

20 cycle is optional; is that correct? 12:28:46

21 A. I believe so. Let me just verify: 12:28:48

22 "... is used to transfer 64-bit address 12:28:50

23 to devices that support 64-bit addressing when 12:28:53

24 the address is not in the low 4 [gigabyte] 12:28:54

25 address space. Targets that support only 32-bit 12:28:59



1 addresses must treat this command as reserved and 12:29:02  
2 not respond to the current transaction in any 12:29:05  
3 way." 12:29:08  
4 So this is kind of a hybrid of 12:29:09  
5 mandatory; it doesn't have to be supported but 12:29:12  
6 then there is a defined reaction to it. 12:29:16  
7 Q. And then the next memory read 12:29:19  
8 line, is that optional or mandatory? 12:29:22  
9 A. It doesn't say optional so it's 12:29:36  
10 required. 12:29:38  
11 Q. And then finally memory write and 12:29:38  
12 invalidate? 12:29:45  
13 A. This is both. Cache semantics; 12:29:47  
14 both don't say it is optional, so mandatory. So 12:29:55  
15 basically most of it is mandatory, as I expected. 12:29:59  
16 Q. So, go back to claim 24, there's 12:30:03  
17 a different, slightly different phrase earlier in 12:30:19  
18 the claim in the inserting step, it says that 12:30:23  
19 the: 12:30:23  
20 "... unidirectional serial channels 12:30:31  
21 that transmit encoded data of Peripheral 12:30:34  
22 Component Interconnect (PCI) bus transactions in 12:30:39  
23 opposite directions ..." 12:30:43  
24 Is it your understanding and the 12:30:48  
25 understanding that you applied in your analysis 12:30:50

1 of encoded data of peripheral component 12:30:52  
2 interconnection bus transaction means an encoded 12:30:57  
3 PCI bus transaction that includes the address and 12:31:03  
4 data phases which includes the PCI address and 12:31:05  
5 bus command information during the address phase 12:31:09  
6 and the PCI data and byte enables during the data 12:31:11  
7 phase? 12:31:15  
8 MR. DAVIS: Objection; form. 12:31:16  
9 THE WITNESS: You're referring to 12:31:29  
10 saying is the word "data" to be interpreted in 12:31:31  
11 the strictest sense of it just being data or data 12:31:35  
12 in the sense of everything containing the 12:31:38  
13 transaction? Did I understand the question 12:31:42  
14 correctly? 12:31:46  
15 BY MR. BUROKER: 12:31:47  
16 Q. Well, right, is there a difference 12:31:47  
17 in your mind in terms of your analysis between 12:31:49  
18 data of PCI bus transaction versus, later in the 12:31:53  
19 claim, address and data bits of PCI bus 12:31:58  
20 transaction? 12:32:03  
21 MR. DAVIS: Objection; form. 12:32:04  
22 THE WITNESS: I notice that there is 12:32:08  
23 a certain amount of redundancy in these claims. 12:32:09  
24 Here I would say it means the encoded data as 12:32:16  
25 data phases of the PCI transaction, but later 12:32:22

1           it's more detailed further in to include the           12:32:25  
2           addresses as well.           12:32:35  
3           BY MR. BUROKER:           12:32:38  
4                   Q.    Right, so you would read the           12:32:38  
5           "data" here as referring only to the data phase           12:32:45  
6           of the PCI bus transaction?           12:32:49  
7                   A.    I would say so.   Yes.           12:33:02  
8                   Q.    Okay, and is that because the word           12:33:05  
9           "address", is not explicitly included?           12:33:07  
10                  A.    Yes.           12:33:12  
11                  Q.    Okay.   But earlier the command           12:33:12  
12           information was not explicitly included in the           12:33:18  
13           phrase "address and data bits of PCI bus           12:33:21  
14           transaction" and I think you said that you had to           12:33:24  
15           transmit the command information done in that           12:33:28  
16           claim; is that correct?           12:33:31  
17                  A.    I remember that.   For it to make           12:33:32  
18           sense it has to include that, yeah.           12:33:34  
19                  Q.    And so in the first instance for           12:33:37  
20           it to make sense you don't have to send the           12:33:40  
21           address information or the command information in           12:33:42  
22           the "transmit encoded data of PCI bus           12:33:47  
23           transaction" clause?           12:33:52  
24                  A.    I notice you're trying to           12:33:54  
25           construct a contradiction here, yeah.           12:33:56

1                   Q.    I'm not trying to do anything, I'm                   12:33:58  
2                   asking you questions.  It's your understanding               12:34:00  
3                   that you applied in your analysis.                   12:34:06  
4                   A.    Let me just ...                   12:34:14  
5                   MR. DAVIS:  I object to form on the                   12:34:25  
6                   last question.                   12:34:26  
7                   THE WITNESS:  Well one claim says                   12:34:29  
8                   "address and data bits of PCI bus transaction"               12:34:40  
9                   but always referring to PCI bus transactions and               12:34:44  
10                  up here it says "data of PCI bus transaction", it            12:34:48  
11                  says "encoded data".                   12:34:58  
12                  BY MR. BUROKER:                   12:35:12  
13                  Q.    So let me just make it a simpler                   12:35:12  
14                  question.  As you applied claim 24, what did you               12:35:14  
15                  understand the phrase "data of PCI bus                   12:35:23  
16                  transaction" to be?                   12:35:27  
17                  A.    I always saw this in the context                   12:35:32  
18                  of the PCI transaction, bus transaction.                   12:35:34  
19                  Q.    Meaning that it was the data phase                   12:35:38  
20                  of the PCI bus transaction?                   12:35:39  
21                  A.    Yeah.  Let me rethink this.                   12:35:47  
22                  Because in both cases, whether we are talking               12:36:06  
23                  about the lower part of the claim or the upper               12:36:09  
24                  part of the claim, there has to be the PCI                   12:36:11  
25                  transaction information in there otherwise this               12:36:16

1 sentence wouldn't make much sense. 12:36:22

2 Q. So there are other asserted 12:36:25

3 claims, so claim 31 of the same patent doesn't 12:36:29

4 have the "encoded data" language, but it does 12:36:36

5 have the "address and data bits of PCI bus 12:36:40

6 transaction in serial form". Do you see that? 12:36:43

7 A. Yeah. 12:36:45

8 Q. Okay. And then claim 54 of the 12:36:46

9 '873 Patent -- which is the other asserted claim, 12:36:51

10 that's the other one you've got there -- in the 12:36:54

11 low voltage differential signal channel element 12:37:09

12 it uses the phrase: 12:37:13

13 "... communicating an encoded serial 12:37:18

14 bit stream of ... PCI bus transaction." 12:37:21

15 Do you see that? 12:37:23

16 A. Yes. 12:37:24

17 Q. Okay. So, what do you understand 12:37:25

18 the serial bit stream of PCI bus transaction to 12:37:30

19 be? And which interpretation did you apply in 12:37:33

20 your analysis? 12:37:39

21 A. We're referring to a PCI bus 12:37:49

22 transaction, so the information which PCI bus 12:37:53

23 transaction is ongoing, what state it is at any 12:37:58

24 particular time has to be conveyed, and it is 12:38:01

25 being encoded and submitted as a serial bit 12:38:03

1 stream. So, whatever constitutes to a PCI bus 12:38:07  
2 transaction, the relevant signals -- and we went 12:38:13  
3 through it -- would have to be encoded in serial 12:38:18  
4 form. 12:38:24

5 Q. So the whole PCI bus transaction 12:38:25  
6 including any command information or byte 12:38:29  
7 enables, including the address and data, that 12:38:35  
8 whole thing would have to be encoded in serial 12:38:37  
9 form? 12:38:42

10 A. Yes. 12:38:45

11 MR. BUROKER: Why don't we take a break 12:39:08  
12 for lunch? 12:39:09

13 (Lunch recess taken 12:39 p.m. - 1:26 p.m.) 12:39:10

14 BY MR. BUROKER: 01:26:31

15 Q. Welcome back. I should have said 01:26:32  
16 this at the beginning, but you did not talk about 01:26:36  
17 the substance of your testimony with your counsel 01:26:38  
18 at the lunch break, did you? 01:26:41

19 A. (The witness shook his head.) 01:26:44

20 Q. Yeah, great. That was a "no", 01:26:44  
21 correct? 01:26:45

22 A. This is an affirmative. 01:26:46

23 Q. That you did not? 01:26:49

24 A. I did not. 01:26:52

25 Q. I apologize for the negative 01:26:53

1	question.	01:26:55
2	A. That's fine, don't worry. I did	01:26:56
3	not think I should.	01:26:58
4	Q. I have a question going back to	01:26:59
5	the PCI specification document. You were looking	01:27:02
6	I believe at page 36 at the read transaction as	01:27:04
7	an example of a transaction.	01:27:06
8	MR. DAVIS: Are you pointing at page 36	01:27:21
9	of the document?	01:27:23
10	MR. BUROKER: Oh, I'm sorry 36 of the	01:27:25
11	document, which is page 52 of the exhibit. It's	01:27:27
12	the 3.3.1 Read Transaction section.	01:27:30
13	A. Okay, this the one.	01:27:56
14	Q. Okay, so we were looking at this	01:27:58
15	earlier this morning, correct?	01:28:01
16	A. Yes.	01:28:02
17	Q. Are some of the elements along the	01:28:10
18	left-hand side called control lines in the PCI	01:28:11
19	specification?	01:28:14
20	A. I would consider them as such,	01:28:21
21	whether they are explicitly called control	01:28:23
22	signals I would have to check. But basically in	01:28:26
23	bus terminology you have the address, the data	01:28:33
24	and then additional corollary signals which	01:28:38
25	basically define what's going on, right? And	01:28:42

1           those constitute, in this case, the combined byte           01:28:44  
2           enables, then the initiator ready, target           01:28:49  
3           ready -- IRDY and TRDY -- which are basically           01:28:53  
4           used for the flow control, and the device select           01:28:58  
5           which is used for enabling the device to claim           01:29:01  
6           its existence in the bus.           01:29:04  
7                   Q.     What is the "frame#" what is that?           01:29:05  
8                   A.     And frame, of course, excuse me.           01:29:09  
9           The frame. The frame signal is there to define           01:29:10  
10          the length of the transaction. This is a very           01:29:14  
11          fundamental thing because, unlike in other cases,           01:29:17  
12          in particular typically in networks, where the           01:29:21  
13          length of the packet is basically submitted as           01:29:24  
14          one of the very first words in the head of the           01:29:27  
15          packet saying, "This is it" and, "This is how           01:29:29  
16          long it will be." In PCI this doesn't exist. So           01:29:31  
17          a target being connected has no way of knowing           01:29:35  
18          how long this transaction will end up being,           01:29:37  
19          right? It will only know here is an address and           01:29:41  
20          here is a command, what is going to happen? And           01:29:44  
21          the length of the transaction is determined by           01:29:46  
22          the length the frame signal is asserted and if           01:29:48  
23          you refer, for instance, to column 8, clock cycle           01:29:52  
24          8, you see that there is one last data transfer           01:29:56  
25          when frame is already high. This is basically           01:30:00



1 an efficiency thing which says since you have to 01:30:03  
2 de-assert, make invalid the frame signal at the 01:30:09  
3 end of the cycle to enable the next cycle, the 01:30:12  
4 idea was to use that mandatory state for another 01:30:17  
5 data phase in order not to have a dead state in 01:30:22  
6 the bus protocol. 01:30:25

7 Q. Okay. So in a PCI bus are there 01:30:26  
8 separate lines for frame number, IRDY, TRDY, 01:30:37  
9 DEVSEL? 01:30:48

10 A. Yes. 01:30:48

11 Q. Okay. So of the 37 lines of a PCI 01:30:49  
12 bus, those take up five of the bits; is that 01:30:53  
13 correct? Or five of the lines I'm sorry. 01:31:01

14 A. If the sum is 37, I'm not 01:31:03  
15 100 percent sure. But if you refer to Figure 2-1 01:31:05  
16 on page 7 of the same document they are nicely 01:31:08  
17 outlined. So, for example, one signal which is 01:31:11  
18 also always part of the game which is not shown 01:31:11  
19 here -- 01:31:11

20 Q. Sorry, did you say Figure 2-1? 01:31:11

21 A. Figure 2-1. The PCI pin list. 01:31:11

22 Q. Which page is that on? 01:31:31

23 A. Page 7 or 23. 01:31:31

24 So there is also the parity signal which 01:31:36  
25 is used for signal integrity and then you see 01:31:38

here it's called the control signals, frame,	01:31:41
target ready, initiator ready. There is in	01:31:47
addition the stop signal which is not disclosed	01:31:53
in this diagram, which enables a device to say,	01:31:55
"Terminate the transaction, no point going	01:31:59
further, illegal address", something like that.	01:32:01
So there are other transactions showing that in	01:32:04
this spec and then device select and ID select.	01:32:08

Q. Yeah, I said 37 but I think it says at the top of page 7, 47 pins not 37, right?

"The PCI interface requires a minimum	01:32:18
of 47 pins for a target-only device and 49 pins	01:32:20
for a master to handle data in addressing,	01:32:24
interface control, arbitration and system	01:32:28
functions."	01:32:30

Correct? 01:32:31

A. 37 seemed a bit low to me, yeah. 01:32:31

Q. Do these control lines, such as  
frame, target ready, and so forth, are they part  
of the PCI bus transaction as you understand that  
term in the claims of the patent?

MR. DAVIS: Objection; form. 01:32:58

BY MR. BUROKER: 01:32:59

Q. So, you know, earlier we were 01:32:59  
talking about what your understanding of the term 01:33:00

1 "PCI bus transaction", looking at paragraph 114, 01:33:03  
2 for example, of your declaration, and you stated 01:33:06  
3 claims require address and data phases of a PCI 01:33:10  
4 bus transaction, et cetera. Are these control 01:33:17  
5 lines also part of what the claims require as 01:33:19  
6 a PCI bus transaction? 01:33:26

7 A. Since they are required to define 01:33:27  
8 what is going on on the bus at any point in time, 01:33:30  
9 the answer is yes. They define the PCI 01:33:34  
10 transaction. If you, for example, would remove 01:33:37  
11 from one byte enable you have no way of knowing 01:33:41  
12 whether we are reading, writing, or what other 01:33:46  
13 functionality is to be executed. If you remove 01:33:49  
14 any of the flow control signals, you cannot steer 01:33:51  
15 the fact if a device is not immediately ready, 01:33:57  
16 which happens a lot. So they would have to be -- 01:33:59  
17 they define the transaction, so have to be there. 01:34:05

18 Q. Okay. Looking at claim 24 as 01:34:09  
19 an example again. 01:34:14

20 A. Just wait, wait, wait. And we are 01:34:20  
21 talking now '873? 01:34:21

22 Q. No, '814 Patent, claim 24. 01:34:36  
23 The complete phrase that we were looking 01:34:36  
24 at talks about communicating address and data 01:34:38  
25 bits of PCI bus transaction in serial form. Do 01:34:47

1           you see that? 01:34:49

2                   A.    Yes. 01:34:49

3                   Q.    PCI bus transactions are not 01:34:54

4 naturally in a serial form, correct? 01:34:56

5                   A.    They are not defined in a serial 01:34:58

6 form in this document, correct. 01:34:59

7                   Q.    So if you take the transaction and 01:35:10

8 transform it into a serial format, is the result 01:35:13

9 still a PCI bus transaction? 01:35:16

10                  MR. DAVIS:  Objection; form. 01:35:20

11 (Brief pause to re-establish realtime connections.) 01:38:22

12 BY MR. BUROKER: 01:38:22

13                  Q.    Since we had a little bit of 01:38:23

14 a technical issue, I'll just ask a new question. 01:38:24

15                  The phrase is: 01:38:27

16                  "... to communicate ... [the] PCI bus 01:38:28

17 transaction in serial form ..." 01:38:31

18                  What does it mean to you to communicate 01:38:35

19 a PCI bus transaction in serial form? 01:38:38

20                  MR. DAVIS:  Objection; form. 01:38:42

21 BY MR. BUROKER: 01:38:46

22                  Q.    Well in actual fact let me ask 01:38:47

23 a different question. 01:38:49

24                  So the full language, and I'll give it 01:38:49

25 to you, is: 01:38:51

2 A. Yes. 01:34:49

3 Q. PCI bus transactions are not 01:34:54

4 naturally in a serial form, correct? 01:34:56

5                   A.    They are not defined in a serial                   01:34:58

6 form in this document, correct. 01:34:59

7 Q. So if you take the transaction and 01:35:10

```
8      transform it into a serial format, is the result
```

```
9          still a PCI bus transaction?                                01:35:16
```

10 MR. DAVIS: Objection; form. 01:35:20

```
11      (Brief pause to re-establish realtime connections.)                                01:38:22
```

12 BY MR. BUROKER: 01:38:22

13 Q. Since we had a little bit of 01:38:23

14 a technical issue, I'll just ask a new question. 01:38:24

15 The phrase is: 01:38:27

```
16          "... to communicate ... [the] PCI bus                                01:38:28
```

17 transaction in serial form ..."

18 What does it mean to you to communicate 01:38:35

```
19      a PCI bus transaction in serial form?                                01:38:38
```

20 MR. DAVIS: Objection; form. 01:38:42

21 BY MR. BUROKER: 01:38:46

22 Q. Well in actual fact let me ask 01:38:47

23 a different question. 01:38:49

24 So the full language, and I'll give it 01:38:49

25 to you, is: 01:38:51

1                   "... to communicate address and data                   01:38:52  
2           bits of PCI bus transaction in serial form ... "                   01:38:54  
3                   What does the phrase "in serial form"                   01:38:56  
4           in that phrase mean?                   01:39:01  
5                   A.    I mean, I defined even in                   01:39:04  
6           particular this serial transmission here, and,                   01:39:08  
7           let me just see, '814, there were a few terms                   01:39:18  
8           which I believe have been defined, now I just                   01:39:21  
9           have to see that I find it real quick, serial                   01:39:24  
10          communication, page 28 of this document. And                   01:39:27  
11          although I am quite sure I remember off the top                   01:39:33  
12          of my head, I'd rather refer to it. We say here:                   01:39:39  
13                   "Serial communication protocols ... "                   01:39:44  
14                  -- and I was instructed to speak really                   01:39:48  
15          slow when I read because I was not doing this --                   01:39:50  
16                   "... send bits of information one after                   01:39:53  
17          another on one or more lines that are used to                   01:39:54  
18          make up words. A communication scheme is said to                   01:39:57  
19          be serial if the information sent over the serial                   01:40:05  
20          lines has more bits in a word than there are                   01:40:07  
21          physical lines to transmit those bits."                   01:40:10  
22                   And then there is more details, but I                   01:40:12  
23          think this is maybe already good enough for this.                   01:40:15  
24                   So that means the information defining                   01:40:19  
25          a PCI transaction is sent over a number of                   01:40:23

1	signals which are obviously less than what we	01:40:28
2	have here. The corollary to that technically	01:40:32
3	would mean it would have to be at a higher rate	01:40:37
4	in order to keep up.	01:40:40
5	Q. And while that information is	01:40:42
6	being transmitted over the serial line, is it	01:40:44
7	still a PCI bus transaction?	01:40:48
8	MR. DAVIS: Objection to form.	01:40:54
9	THE WITNESS: Here I would stick to the	01:40:59
10	specification and one of the functionalities and	01:41:03
11	features of a specification requires that	01:41:07
12	compliant devices can communicate with each other	01:41:09
13	directly. So with a serialized version of this,	01:41:13
14	although the entire information may be there but	01:41:19
15	in a different form, one could not connect	01:41:21
16	directly a PCI compliant device for it to work,	01:41:24
17	it would have to be reconverted into the ordinary	01:41:28
18	or defined PCI format for this to work.	01:41:31
19	BY MR. BUROKER:	01:41:35
20	Q. So the claims, in your reading,	01:41:35
21	contemplate some sort of transformation of the	01:41:38
22	PCI bus transaction into a format that is	01:41:43
23	serially transmitted and then, on the other end,	01:41:48
24	it would be converted back into PCI bus	01:41:53
25	transaction format?	01:41:58

1	MR. DAVIS: Objection; form.	01:41:58
2	THE WITNESS: The patent text outlines	01:42:01
3	this in great detail, and this is the context in	01:42:04
4	which I would read this claim. Because it has to	01:42:06
5	be seen in the context of the patent. So yes.	01:42:12
6	BY MR. BUROKER:	01:42:17
7	Q. If you add information to the PCI	01:42:44
8	bus transaction is that resulting set of data	01:42:46
9	still a PCI bus transaction?	01:42:54
10	MR. DAVIS: Objection; form.	01:42:58
11	THE WITNESS: Can you be more specific?	01:43:01
12	BY MR. BUROKER:	01:43:03
13	Q. Right, so if there's 47 lines in	01:43:03
14	a PCI bus transaction, if you add five additional	01:43:06
15	lines of information for whatever reason, is the	01:43:12
16	resulting 55-bit piece of information still a PCI	01:43:15
17	bus transaction?	01:43:21
18	MR. DAVIS: Objection; form.	01:43:23
19	THE WITNESS: The game about standards	01:43:28
20	is quite clear: what is in the standard is what	01:43:29
21	it is, no more no less. So answering your	01:43:33
22	question, I say what you have now is some	01:43:37
23	superset of a PCI transaction, which would be	01:43:42
24	part of something else. That additional	01:43:44
25	information has no meaning with respect to the	01:43:47

1 PCI transaction. 01:43:49

2 BY MR. BUROKER: 01:43:53

3 Q. Right, so let me just refer you to 01:43:53

4 paragraph 80 of your declaration. You discuss 01:43:57

5 some of the figures from the '814 Patent, right? 01:44:09

6 And 80 is fairly long with lots of figures, so if 01:44:15

7 you need to read it that's fine. 01:44:18

8 In there you note that the inventor in 01:44:20

9 these figures contemplates adding something he 01:44:23

10 called bus status bits; is that correct? 01:44:26

11 A. Yeah. 01:44:30

12 Q. Okay. And then the PCI bus 01:44:32

13 transaction plus these bus status bits are 01:44:37

14 encoded into a form that are then set serially 01:44:43

15 over a serial bus. Is that your understanding of 01:44:48

16 what's shown in Figures 13, 14 and 17? 01:44:51

17 A. Let me just see. 14 I can see. 01:44:58

18 Are you talking about the figures in the claim 01:45:11

19 13, 14, 17? I'm sorry. 01:45:15

20 Q. No, the figures in the patent. 01:45:16

21 A. 17 and 14, but where is 13? 01:45:20

22 There's one. Do I have the wrong one? You're 01:45:32

23 talking '814, right? 01:45:34

24 Q. Right, paragraph 80. Within 01:45:36

25 paragraph 80, you have included -- 01:45:40



1                   A.    This diagram, yes, 17.                   01:45:43

2                   Q.    -- Figures 17, 13 and 14 out of           01:45:45

3                   the '814 Patent.                   01:45:51

4                   A.    Oh, sorry, I see this. I took the           01:45:51

5                   whole thing for Figure 14 and I overlooked that       01:45:53

6                   there is a Figure 13 on top of it. Yes, this is           01:45:56

7                   correct.                   01:45:58

8                   Q.    Okay, so you're looking at the           01:45:58

9                   right thing?                   01:46:00

10                  A.    Yes.                   01:46:00

11                  Q.    And then you point to in your           01:46:00

12                  text, you say that what is the label with the red   01:46:03

13                  box -- let's see what number it is -- 5 are what   01:46:06

14                  you call bus status bits. Do you see that?       01:46:19

15                  A.    Yeah.                   01:46:23

16                  Q.    And that's not part of a typical           01:46:23

17                  PCI bus transaction, these bus status bits,       01:46:26

18                  right?                   01:46:28

19                  A.    Correct. They would have to be in           01:46:29

20                  the figure we just looked at on page 7 for it to   01:46:32

21                  be part of the standard.                   01:46:36

22                  Q.    So my question to you is then is           01:46:43

23                  what is shown in Figure 13 and 14 a PCI bus       01:46:47

24                  transaction in serial form?                   01:46:57

25                  A.    Now, I'm --                   01:47:04

1                   MR. DAVIS:  Objection to form.  Sorry,                   01:47:04  
2                   I didn't mean to interrupt.                   01:47:06  
3                   THE WITNESS:  If you look at page 49,                   01:47:09  
4                   it says the bus status bits:                   01:47:17  
5                   "... BS0 [through] BS3 in Figures 13                   01:47:21  
6                   and 14 are 'bus status' bits added by the                   01:47:24  
7                   inventor to facilitate serialized communication                   01:47:32  
8                   and form 10 bit packets, which may include                   01:47:38  
9                   PCI-related information like the FRAME ...                   01:47:42  
10                   [initiator and target ready] signals."                   01:47:47  
11                   So basically they put it there and have                   01:47:49  
12                   given it just a different name, but this is                   01:47:57  
13                   basically the placeholder for these PCI-related                   01:48:01  
14                   signals.  But they may have different meanings                   01:48:04  
15                   depending on whether or not the signal goes                   01:48:08  
16                   initiator to target or target to initiator                   01:48:11  
17                   because these are unidirectional signals.                   01:48:13  
18                   So the conclusion to say these are not                   01:48:18  
19                   PCI signals is not exactly correct.  These are                   01:48:20  
20                   PCI signals, it's just a different name for                   01:48:23  
21                   a kind of a placeholder, if you want to code                   01:48:28  
22                   them.                   01:48:30  
23                   BY MR. BUROKER:                   01:48:31  
24                   Q.  So they've taken the PCI-required                   01:48:31  
25                   signals and created placeholders for them.  Was                   01:48:35

1 the result of that still PCI bus transaction or 01:48:40  
2 is it something different? 01:48:43  
3 MR. DAVIS: Objection; form. 01:48:45  
4 THE WITNESS: I mean, that discussion 01:48:48  
5 we had before, this is a serialized version of 01:48:49  
6 a PCI bus transaction which has to include 01:48:54  
7 everything necessary to define that transaction 01:48:55  
8 accurately, but this particular encoding signals 01:48:58  
9 on wires sequences of bits on those signals is 01:49:04  
10 not, in the strict sense of the specification, 01:49:11  
11 a PCI bus anymore, but it has everything in it to 01:49:14  
12 very easily recreate it, which is an important 01:49:19  
13 thing. One to one create it with all details in 01:49:21  
14 it. Right? So, for example, also the definition 01:49:27  
15 what is the sequence of address bits which go on 01:49:36  
16 to the individual signal lines because we have a 01:49:39  
17 tenfold increase in clock rate enabling to get 01:49:44  
18 the number of parallel signals appropriately 01:49:47  
19 down. 01:49:52  
20 BY MR. BUROKER: 01:49:53  
21 Q. So, in summary, is it your 01:49:53  
22 understanding that the phrase we looked at in 01:49:57  
23 claim 24 requires that what is communicated are 01:50:00  
24 all of the pieces of information needed to 01:50:05  
25 recreate the PCI bus transaction on the other end 01:50:08

1 of the serial transmission? 01:50:13

2 A. Right, the PC -- 01:50:15

3 MR. DAVIS: Just pause and let me 01:50:18

4 object in between. Objection; form. 01:50:19

5 BY MR. BUROKER: 01:50:23

6 Q. You can answer. 01:50:23

7 A. I shouldn't give quick answers so 01:50:25

8 that we don't have these collisions. 01:50:27

9 Q. Do you need her to read back? 01:50:27

10 A. Yeah, I apologize, could you? 01:50:51

11 (The record was read back.) 01:50:51

12 MR. DAVIS: Objection; form. 01:50:51

13 THE WITNESS: Again, and I confirm that 01:50:53

14 and wish to add, of course, the PCI bus 01:50:56

15 transaction initiated by the bus master at the 01:50:59

16 other side of this interface. It's not any PCI 01:51:02

17 bus transaction, it's the particular one on the 01:51:07

18 other side of the interface. 01:51:10

19 BY MR. BUROKER: 01:51:23

20 Q. So, the second term that was 01:51:25

21 discussed is the word "encoded" and it's 01:51:29

22 paragraph 116 where that section starts and goes 01:51:34

23 through 120. 01:51:39

24 So in paragraph 116 you state that you 01:51:45

25 believe that the broadest reasonable 01:51:49

1 interpretation of encoded requires that it must 01:51:51  
2 be reversible; is that correct? 01:51:56  
3 A. That's correct. 01:52:00  
4 Q. Okay. And is that language, the 01:52:01  
5 reversible language, required by the IBM 01:52:08  
6 technical dictionary you cite? 01:52:14  
7 A. Yes. 01:52:16  
8 Q. Where is that? 01:52:16  
9 A. It's a bit of a complicated 01:52:33  
10 language in this dictionary. Encoding -- well, I 01:52:35  
11 mean it defines here first of all the term 01:52:43  
12 "code", which is: 01:52:46  
13 "A set of rules that maps the elements 01:52:47  
14 of one set onto the elements of another set ... 01:52:50  
15 The first set is the coded set and the second set 01:52:53  
16 is the code element set. [The] element of [one] 01:52:56  
17 code element may be related to more than one 01:52:59  
18 element of the coded set but the reverse is not 01:53:02  
19 true." 01:53:05  
20 That means basically you have many ways 01:53:05  
21 of encoding but there's always the one-to-one 01:53:07  
22 relationship. One example the famous ASCII code, 01:53:10  
23 turning letters into codes. There is 01:53:15  
24 a one-to-one relationship for every letter being 01:53:19  
25 a code. For example, capital A is hexadecimal 01:53:22

1           41. And this is a one-to-one relationship.           01:53:28  
2           Anything else wouldn't make sense because once           01:53:32  
3           you have the code you couldn't recreate the           01:53:34  
4           letter if there was an ambiguity. But there are           01:53:36  
5           other codes, for example, Unicode. It turns out           01:53:39  
6           ASCII code has limitations. It was invented in           01:53:42  
7           America and at that time people didn't notice           01:53:47  
8           that we have what we call umlaut in Germany,           01:53:50  
9           accents in French, so that all doesn't exist, and           01:53:53  
10          then the entire Arabian space where you have all           01:53:57  
11          these different letters, so Unicode was invented.           01:54:02  
12          While ASCII is a seven-bit code, every character           01:54:07  
13          seven bits, Unicode is a 16-bit code, so you have           01:54:20  
14          65,000 characters possible. And you have to now,           01:54:14  
15          if you have a code, of course tell which is the           01:54:19  
16          context, which coding rules that has been used,           01:54:22  
17          but there always has to be a one-to-one           01:54:25  
18          relationship. Or, in other words, there always           01:54:27  
19          is a decoder for an encoder.           01:54:30  
20                   Q. Let me just hand to you the IBM           01:54:37  
21          dictionary which was being cited here, which was           01:54:40  
22          previously marked Acqis Exhibit 2024 in the '1469           01:54:46  
23          IPR proceeding.           01:54:50  
24                   Do you recognize this set of pages out           01:54:51  
25          of the IBM technical dictionary?           01:54:54

1                   A.    I recognize it.  It's a bit bigger                   01:54:56  
2                   than that, yeah.   01:54:58

3                   Q.    Yes, a little bit bigger.                         01:54:59

4                   So you looked at the definition of                         01:55:01  
5                   "code" and there are 13 actual definitions under             01:55:02  
6                   the word "code".  You cite just one.  Did you                 01:55:10  
7                   look at the others to see if they were                         01:55:14  
8                   applicable?   01:55:17

9                   A.    I mean there is a lot of different                   01:55:27  
10                   examples here, but they all fall under the same                 01:55:29  
11                   fundamental principle I state here, so I believe                01:55:31  
12                   the correct answer here would be then yes, but we                01:55:34  
13                   can go through them to be really absolutely sure:                 01:55:37

14                   "A set of items, such as abbreviations,                         01:55:42  
15                   representing the members of another set."                     01:55:45

16                   It's a generic form of encoding.                             01:55:48

17                   Q.    Definition (2) doesn't explicitly                     01:55:53  
18                   say that coding requires reversibility, does it?               01:55:59

19                   A.    But it's in the context of the                         01:56:12  
20                   overall definition.   01:56:14

21                   Q.    So you read (2) in context of (1).                     01:56:18  
22                   Is that what you're saying?   01:56:21

23                   A.    Yeah.  I mean, this is all under                       01:56:23  
24                   the section "code" anyway.  And also if you use                     01:56:24  
25                   abbreviations to represent a particular member of             01:56:35

1 another set, how much sense does it make if this 01:56:39  
2 abbreviation is ambiguous? 01:56:44

3 Q. Okay. Some other terms are used 01:57:23  
4 in the patent but there's no explicit section, so 01:57:26  
5 I wanted to see if you could explain what you 01:57:30  
6 understood those to mean. So in claim 24 of the 01:57:34  
7 '814 Patent there is the phrase "northbridge" 01:57:37  
8 used, we've talked about that clause a number of 01:57:46  
9 times. What did you understand the phrase 01:57:48  
10 "northbridge" to mean in the context of claim 24 01:57:50  
11 of the '814 Patent? 01:57:53

12 A. I believe I have a drawing in here 01:57:57  
13 which should outline that. In general as being 01:58:00  
14 referred to as the interface device which is 01:58:05  
15 interfacing the processor to the memory and some 01:58:13  
16 additional I/O devices which are typically then 01:58:17  
17 called "southbridge". And the term "northbridge" 01:58:20  
18 basically came from the fact that usually -- here 01:58:22  
19 is an example -- the processor is drawn on top 01:58:26  
20 and -- 01:58:29

21 Q. Sorry, you need to just say what 01:58:30  
22 you're referring to because there's no way to get 01:58:31  
23 that on the transcript. You're looking at what 01:58:34  
24 page of your declaration? 01:58:36

25 A. I'm looking at page 33 of the 01:58:38



1 declaration, which is Figure 1-4, called, "PCI 01:58:40  
2 Based System Showing Implementation of a 01:58:47  
3 PCI-to-PCI Bridge." 01:58:47  
4 It's just one example of a computer. I 01:58:49  
5 mean here you see as an example that the 01:58:53  
6 northbridge functionality, in this example a chip 01:58:56  
7 from Intel, basically interfaces directly to the 01:58:59  
8 processor through its front side bus and on the 01:59:03  
9 other side to the main memory of that processor, 01:59:08  
10 here called SDRAM, to the graphics. This is 01:59:14  
11 an old figure, so it still has the advanced 01:59:17  
12 graphics port (AGP) and at the bottom has 01:59:20  
13 S-interface with the periphery a PCI interface 01:59:24  
14 where the southbridge again interfaces the PCI 01:59:27  
15 also and has a large number of different, much 01:59:30  
16 slower, typically much slower interfaces such as 01:59:34  
17 IDE, USB, ISA bus, and so forth. 01:59:40  
18 Q. And so then the term "peripheral 01:59:47  
19 bridge" is used in claim 31 of the same patent. 01:59:50  
20 What understanding did you give to that term? 01:59:57  
21 A. Peripheral devices a typically 02:00:02  
22 considered -- well, periphery to a computer to 02:00:07  
23 a processor could be anything like a keyboard, 02:00:10  
24 mouse, hard drive, network interfaces and so 02:00:17  
25 force. So a peripheral bridge would be 02:00:21

1	an interface between those devices having very	02:00:23
2	many different possible standards, and the	02:00:29
3	computer, the core of the computer.	02:00:31
4	Q. So claim 31 specifically says that	02:00:37
5	the peripheral bridge is coupled to	02:00:40
6	a microprocessor unit, without an intervening PCI	02:00:44
7	bus. So, in that particular case, the peripheral	02:00:48
8	bridge would have to have a connection to the	02:00:52
9	microprocessor and no intervening peripheral bus;	02:00:56
10	is that right?	02:01:00
11	A. This is what the claim says, yes.	02:01:01
12	Q. Right. And then claim 24, going	02:01:02
13	back, the northbridge, it states, has to be	02:01:07
14	directly coupled to the microprocessor unit. Do	02:01:09
15	you see that?	02:01:14
16	A. Just not yet.	02:01:16
17	Q. In claim 24, it says the	02:01:17
18	northbridge and then it says:	02:01:20
19	"Said north bridge directly coupled to	02:01:23
20	the microprocessor unit."	02:01:25
21	A. Yes, I see, yeah, yeah.	02:01:27
22	Q. And then claim 54 of the '873	02:01:29
23	Patent -- I'm going to have you flip to	02:01:45
24	a different patent -- the last element of claim	02:01:47
25	54 is the peripheral bridge. Do you see that?	02:01:56

1	A. "... directly coupled to the	02:01:59
2	processing unit."	02:02:00
3	Q. Right, so in this case the	02:02:01
4	peripheral bridge has to be directly coupled to	02:02:05
5	the processing unit, not just coupled as in claim	02:02:07
6	31 of the '814, correct?	02:02:09
7	A. It states it that way, yes.	02:02:11
8	Q. And did you use the same	02:02:13
9	understanding of the term "peripheral bridge" in	02:02:15
10	your analysis of both patents? In other words	02:02:18
11	claim 31 of the '814 and claim 54 of the '873	02:02:21
12	patent?	02:02:26
13	MR. DAVIS: Objection; form.	02:02:28
14	THE WITNESS: Peripheral bridge in 31	02:02:49
15	and, excuse me, 54 it was.	02:02:51
16	Yeah, in both cases, there is no	02:02:52
17	further limitation on the peripheral bridge, so	02:03:01
18	the definition holds.	02:03:07
19	BY MR. BUROKER:	02:03:09
20	Q. Is there any minimum set of	02:03:09
21	requirements, that you can think of, that	02:03:11
22	something has to have to be a peripheral bridge	02:03:16
23	as understood in these claims?	02:03:21
24	MR. DAVIS: Objection; form.	02:03:24
25	THE WITNESS: I am not aware of	02:03:30

1	a definition, an official definition what has to	02:03:31
2	be a peripheral bridge like what is PCI standard,	02:03:37
3	but in this context obviously the peripheral	02:03:41
4	bridge has to have an interface to the processor	02:03:48
5	and since the limitation is made clearly directly	02:03:51
6	coupled in some cases, there is obviously	02:03:55
7	different ways to do this and obviously it has to	02:03:59
8	have an interface circuitry to peripheral	02:04:01
9	devices, one or many.	02:04:08
10	BY MR. BUROKER:	02:04:26
11	Q. So we talked about this a little	02:04:26
12	bit, the word in claim 24 of the '814 Patent, the	02:04:27
13	word "communicate" is used, it says:	02:04:32
14	"... the north bridge to	02:04:37
15	communicate ..."	02:04:38
16	-- and then the rest of the clause.	02:04:39
17	What's your understanding of what that verb	02:04:41
18	"communicate" means in the context of claim 24?	02:04:44
19	Let me strike that and say what do you	02:04:54
20	believe the broadest reasonable interpretation of	02:04:56
21	the term "communicate" is that you applied in	02:04:58
22	analyzing the claims versus the references in	02:05:02
23	these IPRs?	02:05:05
24	A. In this case -- and we're talking	02:05:13
25	now the '814 Patent, claim 24 -- the northbridge	02:05:14

1           which communicates, sends this information to           02:05:18  
2           some recipient such that it can decode the           02:05:22  
3           information appropriately or decode (sic).           02:05:26  
4                   Q.    Do you believe communication then           02:05:28  
5           is limited to transmitting and does not include           02:05:31  
6           receiving?           02:05:35  
7                   A.    I'm hesitant to answer immediately           02:05:51  
8           because the claim here basically doesn't specify           02:05:53  
9           who is receiving, but in general communication           02:05:56  
10          makes little sense if nobody receives the           02:05:59  
11          information. That is true, that is clear. It           02:06:01  
12          could be seen implicitly here in the claim.           02:06:05  
13          Obviously it's being received and used.           02:06:07  
14                   Q.    But my question is whether the           02:06:12  
15          northbridge -- if the northbridge only received           02:06:14  
16          address and data bits of PCI bus transaction in           02:06:20  
17          serial form, didn't transmit them, would that           02:06:23  
18          element be met?           02:06:30  
19                   MR. DAVIS: Objection; form.           02:06:32  
20                   BY MR. BUROKER:           02:06:36  
21                   Q.    You might imagine like, I know           02:06:36  
22          that some of these transactions we talked about           02:06:39  
23          are just one-way transactions. So if there was           02:06:43  
24          a northbridge that only received a PCI bus           02:06:46  
25          transaction in serial form and didn't transmit           02:06:49

1	anything in response, would it meet, in your	02:06:54
2	understanding, the requirement of this claim?	02:06:56
3	A. Now, two things. Yes, there are	02:06:59
4	communication channels but now outside of this	02:07:03
5	patent, which could be one-way, right? So, for	02:07:05
6	example, if you switch on the radio and listen to	02:07:13
7	the news there is a communication happening	02:07:16
8	between the radio broadcaster and you receiving	02:07:19
9	that message and there is no way of you talking	02:07:22
10	back. However here we have communication of	02:07:24
11	address and data bits of PCI bus transaction and	02:07:24
12	PCI bus transactions are defined here as being	02:07:33
13	reading and writing and that requires	02:07:34
14	bi-directional communication, right? Simple	02:07:39
15	example, a read transaction requires the bus	02:07:41
16	master, the initiator, to send an address to the	02:07:44
17	target, information goes out. But without data	02:07:46
18	coming back, answering that read, there is no	02:07:51
19	read transaction. So, the fact that this is	02:07:54
20	a communication of a PCI bus transaction requires	02:07:58
21	it to be bi-directional full duplex, as we say.	02:08:00
22	(The court reporter sought	02:08:00
23	clarification.)	02:08:00
24	THE WITNESS: Or a full duplex.	02:08:18
25	BY MR. BUROKER:	02:08:21

1 Q. Bi-directional, I think, right? 02:08:21

2 Sir, that's what you meant to say? 02:08:22

3 A. (The witness nodded.) 02:08:23

4 Q. Yeah, I didn't want to ... 02:08:25

5 A. That might be a bit of a German 02:08:25

6 accent thing. 02:08:29

7 Q. That's fine, I just want to make 02:08:30

8 sure we get a clear record. 02:08:31

9 And then in claim 31, instead of the 02:08:33

10 word "communicate", the language in another part 02:08:40

11 of the claim says "transmit". I'm sorry, no, I 02:08:45

12 meant earlier in the claim, in claim 24, if you 02:08:55

13 look up there. 02:09:00

14 A. Uh-huh. 02:09:00

15 Q. There the language was that the 02:09:02

16 console has an LVDS channel "that transmit 02:09:05

17 encoded data". 02:09:11

18 A. Yeah. 02:09:12

19 Q. So in that situation what is your 02:09:13

20 belief as to the broadest reasonable 02:09:16

21 interpretation of the word "transmit" in claim 02:09:19

22 24? 02:09:22

23 MR. DAVIS: Objection; form. 02:09:23

24 THE WITNESS: I mean we have two 02:09:29

25 unidirectional serial channels that transmit 02:09:39

1	encoded data of peripheral component interconnect	02:09:43
2	bus transactions. So every individual channel is	02:09:49
3	a one way thing but they are opposite direction,	02:09:53
4	so each of the two ones transmit their part of	02:09:57
5	the entire PCI transaction. It goes together.	02:10:02
6	BY MR. BUROKER:	02:10:02
7	Q. But the word "transmit" is	02:10:06
8	a one-way passage of data, it's just in the	02:10:11
9	context of the claim you're saying because there	02:10:17
10	are two pairs --	02:10:19
11	A. Yeah.	02:10:20
12	Q. -- that the serial channel sends	02:10:21
13	things both ways; is that correct?	02:10:22
14	A. Yes, each and every one is	02:10:24
15	a unidirectional but together it is	02:10:26
16	bi-directional again and without that a read	02:10:30
17	transaction would not be possible.	02:10:34
18	Q. So then later on in this claim,	02:10:41
19	the word "convey" is used. So if you look down	02:10:45
20	at the phrase that starts:	02:10:49
21	"The second LVDS channel ..."	02:10:50
22	-- et cetera, et cetera, et cetera.	02:10:52
23	Later on in that same clause it says:	02:10:54
24	"... said second LVDS channel extending	02:10:57
25	from said north bridge to convey said address and	02:11:00



1	data bits of PCI bus transaction in serial form."	02:11:04
2	Do you see where I am?	02:11:10
3	A. Yeah.	02:11:13
4	Q. So what is the broadest reasonable	02:11:14
5	interpretation of the word "convey" in the	02:11:16
6	context of the claim that we just read?	02:11:17
7	A. This is just a different word for	02:11:30
8	the same thing. The information about the PCI	02:11:32
9	bus transaction is communicated or exchanged or	02:11:39
10	conveyed and this is, in this case, done in	02:11:48
11	serial form. I read this such that whoever	02:11:51
12	constructed that claim just used a different word	02:11:57
13	for it to be possibly a bit better readable.	02:12:00
14	Q. Okay, now looking at which patent,	02:12:11
15	54 of the '873?	02:12:15
16	A. Yes.	02:12:17
17	Q. Now I want to ask you about -- we	02:12:32
18	may have touched on this a bit earlier -- the	02:12:35
19	phrase in the second-to-last clause, there's the	02:12:38
20	low-voltage differential signal, that clause.	02:12:41
21	Later on it says:	02:12:44
22	"... to transmit data in opposite	02:12:47
23	directions for communicating an ..."	02:12:49
24	-- and here's the question --	02:12:52
25	"... encoded serial bit stream of ...	02:12:54

1 (PCI) bus transaction ..." 02:12:56

2 Does that mean that all of the elements 02:13:01

3 of the PCI bus transaction have to be encoded, 02:13:07

4 including the address data control signals, 02:13:13

5 et cetera? 02:13:18

6 A. Whatever pertains to the PCI 02:13:18

7 transaction otherwise it wouldn't be complete, 02:13:21

8 yeah. 02:13:23

9 Q. And to your understanding of the 02:13:24

10 broadest reasonable interpretation, the encoding 02:13:27

11 must be done in such a way that it's reversible 02:13:29

12 on the receiving end; is that correct? 02:13:32

13 A. Absolutely, I mean, in particular 02:13:34

14 also if you look at this in the context of this 02:13:38

15 patent it wouldn't make much sense if this 02:13:43

16 encoding would not be reversible because then the 02:13:47

17 far end would not be able to recreate the 02:13:49

18 transaction. 02:13:51

19 Q. I'll direct you to page 91 (sic) 02:14:09

20 of your '814 declaration? 02:14:11

21 A. Yeah. 02:14:31

22 Q. You're talking about the TNet 02:14:32

23 solution -- which is TNet, T-N-e-t -- from the 02:14:41

24 Horst reference that we'll be talking about 02:14:41

25 shortly. But you say: 02:14:44

1	"The TNet solution, discussed in the	02:14:45
2	Horst reference, was not solving the same problem	02:14:48
3	as that encountered by Dr. Chu in the '814	02:14:51
4	patent."	02:14:54
5	Do you see where I'm talking about?	02:14:55
6	A. Not quite yet.	02:14:57
7	Q. The very first sentence of	02:14:59
8	paragraph 91.	02:15:00
9	A. Oh, I have page 91. That's	02:15:01
10	something else.	02:15:05
11	Q. Oh, that's not the same.	02:15:06
12	A. Yes. I'm right there.	02:15:12
13	Q. Okay. So is it your understanding	02:15:13
14	that a prior reference has to be solving the same	02:15:21
15	problem as the inventor in order to invalidate	02:15:25
16	it?	02:15:32
17	A. No, it does not.	02:15:32
18	Q. So what was the reason that you	02:15:33
19	said they're not solving the same problem?	02:15:35
20	A. Whatever has been cited as prior	02:15:41
21	art has to make sense as a functioning system if	02:15:45
22	put together and, I mean, this is just the	02:15:49
23	introductory sentence to a rather long chain of	02:15:53
24	arguments, where these things are detailed more.	02:15:57
25	So taking out of context, yes, this is not enough	02:16:03

1 to make this plain. The fundamental difference 02:16:05  
2 between these two scenarios, what is described in 02:16:12  
3 the patent and what is outlined in the Horst 02:16:17  
4 reference is basically one is a parallel computer 02:16:20  
5 system, supporting up to, I believe, a million of 02:16:24  
6 nodes, where the other is something where you 02:16:26  
7 have one single computer with a completely 02:16:30  
8 confined context and functionality allowing to 02:16:33  
9 connect an I/O subsystem or a console in a highly 02:16:38  
10 efficient way. So many of the things required in 02:16:43  
11 this context to be there would hinder what is 02:16:51  
12 disclosed by Chu and if one would try to 02:16:57  
13 introduce, to basically impose what is disclosed 02:17:00  
14 by Chu on TNet it wouldn't work anymore, you have 02:17:04  
15 a single address base in PCI and you cannot 02:17:07  
16 possibly have that in such a distributed system. 02:17:10  
17 Q. So it's not your understanding, 02:17:16  
18 and you were not trying to, as part of your 02:17:18  
19 invalidity analysis, determine that the claims 02:17:23  
20 solved the same problem as the prior art? That 02:17:27  
21 was not something that you felt like you had to 02:17:29  
22 find in order for there to be invalidity, right? 02:17:31  
23 Let me ask that again. 02:17:35  
24 You were not operating under the 02:17:38  
25 understanding that to show something is invalid, 02:17:39

1	a claim is invalid based on a reference that the	02:17:41
2	claim and the reference are addressed to the same	02:17:44
3	problem?	02:17:47
4	A. This is not a requirement, but if	02:17:50
5	you ask about the basics of the analysis, I have	02:17:51
6	that outlined, starting at page 10, right? I	02:17:58
7	mean this is the whole claim construction	02:18:02
8	business. In particular this is about	02:18:05
9	anticipation and obviousness, right? And both	02:18:08
10	principles I have applied to the best of my	02:18:13
11	knowledge. I guess the most important one is	02:18:15
12	about obviousness, right? Most of the claims	02:18:19
13	which are under discussion here are on the	02:18:25
14	obviousness issue. I mean there's quite a bit of	02:18:29
15	text which I put in, you know, hoping to make it	02:18:35
16	clear.	02:18:39
17	Q. So you just mentioned that one of	02:18:40
18	the differences with Chu and the Horst reference	02:18:43
19	had to do with addressing and you indicate that	02:18:47
20	the Horst reference uses virtual addressing; is	02:18:54
21	that correct?	02:18:57
22	A. This is correct and it is stated	02:18:58
23	in the Horst reference which means now would be	02:19:00
24	a good time --	02:19:03
25	Q. Do you need a copy?	02:19:05

1                   A.    -- to have it so that I can point                   02:19:06  
2                   you to, if I can find it quickly. But it makes               02:19:08  
3                   a clear point, and there is also a technical               02:19:12  
4                   requirement for this to be the case. It's               02:19:15  
5                   similar in SCI.   02:19:22  
6                   Q.    So this is Horst, which is 1009 in               02:19:25  
7                   '814 IPR but it is also 1011 in the '873 IPR. So           02:19:31  
8                   I'm giving you the copy that was marked 1009 in           02:19:38  
9                   the '814.   02:19:41  
10                   So my question I was going to ask you is               02:19:54  
11                   really about virtual addressing versus physical           02:19:59  
12                   addressing which you say that PCI devices use           02:20:03  
13                   physical addressing; is that correct?               02:20:08  
14                   A.    Yes.   02:20:10  
15                   Q.    And is it your understanding that               02:20:12  
16                   the claims that are at issue in these IPR               02:20:14  
17                   proceedings exclude virtual addressing?           02:20:18  
18                   MR. DAVIS: Objection; form.                       02:20:22  
19                   THE WITNESS: I mean you now ask for               02:20:26  
20                   all claims?   02:20:27  
21                   BY MR. BUROKER:                                       02:20:29  
22                   Q.    No, no, the claims in the IPR               02:20:29  
23                   proceedings, we can start with claim 24 in the           02:20:31  
24                   '814. Is there any language you were looking at       02:20:34  
25                   where it says virtual addressing is excluded?           02:20:38

1                   A.    It says always in the context of                   02:20:44  
2                   addresses, addresses of PCI bus transaction.               02:20:51  
3                   Since PCI bus transactions are meant, it has to           02:20:55  
4                   be physical addresses. So this is basically part           02:20:59  
5                   of the context of it being PCI, right?                   02:21:01  
6                   And let me maybe to have a clean                   02:21:04  
7                   differentiation between a virtual and physical           02:21:12  
8                   addresses, because I'm sure we will have more of           02:21:14  
9                   that. The important thing is a physical address           02:21:17  
10                  enables to locate the particular device or the           02:21:23  
11                  particular word in memory unambiguously. This is           02:21:26  
12                  what it is. Unlike a virtual address. And since           02:21:31  
13                  these claims are about the physical I/O bus PCI           02:21:36  
14                  using physical addresses, because in here the PCI           02:21:41  
15                  address is used to select the device connected on           02:21:44  
16                  the bus, and there could be any number of devices           02:21:47  
17                  connected there. It has to be a physical                   02:21:49  
18                  address. The final result of any                   02:21:52  
19                  physical-to-virtual -- sorry, virtual-to-physical           02:21:55  
20                  address translation. I misspoke.                   02:22:01  
21                  Q.    Would you agree the claim 24                   02:22:06  
22                  contemplates the creation of a serial form of the           02:22:13  
23                  PCI bus transaction?                   02:22:19  
24                  A.    I mean I would stick to the exact                   02:22:41  
25                  claim language and, I mean, it says really               02:22:43

1	clearly:	02:22:53
2	"... serial channels that transmit	02:22:55
3	encoded data of Peripheral Competent Interconnect	02:22:57
4	(PCI) bus transaction in opposite directions ..."	02:23:03
5	-- saying the PCI transaction is	02:23:04
6	communicated in serial form. That doesn't	02:23:08
7	constitute that a new standard is created calling	02:23:11
8	it a serial PCI bus, and I don't think there is	02:23:15
9	any attempt in here. This is something which was	02:23:19
10	invented in order to avoid all the complications	02:23:23
11	with big high pin count connectors limiting the	02:23:27
12	speed of communication for a very specific	02:23:31
13	purpose.	02:23:34
14	Q. As part of communicating the PCI	02:23:38
15	bus transaction in serial form, couldn't you	02:23:46
16	create or use virtual addressing as part of that	02:23:50
17	serial communication?	02:24:00
18	MR. DAVIS: Objection; form.	02:24:04
19	THE WITNESS: We have a bus here, which	02:24:07
20	is identified to address physical devices.	02:24:14
21	Communicating a virtual address on such a bus	02:24:21
22	would not allow the direct addressing of such	02:24:25
23	devices, therefore it wouldn't make any sense.	02:24:29
24	Basically all computers when communicating with	02:24:33
25	I/O devices have done their address translation	02:24:41



1	beforehand.	02:24:45
2	BY MR. BUROKER:	02:24:47
3	Q. So by that explanation, for this	02:24:47
4	claim to make sense, then no matter what device	02:24:52
5	receives this information, it has to be using	02:24:56
6	a PCI bus address that is understood and known by	02:25:03
7	the northbridge that sent it; is that right?	02:25:09
8	MR. DAVIS: Objection; form.	02:25:16
9	BY MR. BUROKER:	02:25:21
10	Q. Let me strike that and let me	02:25:21
11	start over.	02:25:22
12	So if I'm going to take a PCI bus	02:25:23
13	transaction and I'm going to serialize it, and on	02:25:25
14	the other side it's going to come back and be	02:25:29
15	recreated, any PCI device on the other end of	02:25:32
16	that serial transmission has to be using the same	02:25:34
17	addressing scheme as the transmitting side,	02:25:37
18	correct?	02:25:42
19	A. It's part of the overall address	02:25:43
20	map of the computer, correct. But --	02:25:46
21	Q. So you couldn't have, in that	02:25:50
22	situation, a PCI device on one side of the serial	02:25:53
23	transmission and then one on the other one that	02:25:58
24	has the same address?	02:26:00
25	A. No.	02:26:02

1	Q.	It wouldn't work?	02:26:04
2	A.	Not a good thing.	02:26:04
3	Q.	You would have a collision,	02:26:05
4		correct?	02:26:06
5	A.	Correct. This is actually one of	02:26:07
6		the fundamental differences in the big new thing	02:26:09
7		which came about in the context of PCI because	02:26:14
8		that is one of the big issues we had with VME,	02:26:18
9		which is also part of the prior art being cited	02:26:21
10		here so it makes sense. In VME the address map	02:26:25
11		had to be defined before you switch on the	02:26:27
12		computer and you do this on a piece of paper and	02:26:29
13		then you had a little row of switches on all the	02:26:31
14		I/O devices where you defined this is your slave	02:26:35
15		address, and if by accident you enable two	02:26:39
16		devices on the same slave address you have a	02:26:41
17		non-working computer which even could end up in	02:26:44
18		hardware damage.	02:26:47
19		In PCI the system works differently.	02:26:47
20		When your computer wakes up all devices are	02:26:49
21		basically dead, disabled, do nothing. Then the	02:26:55
22		computer basically goes step by step through the	02:26:58
23		entire PCI tree, and this can be quite a few	02:27:00
24		devices, potential devices. It will address	02:27:03
25		every particular physical slot in the computer	02:27:07

1 connection device and this is why PCI has to have 02:27:11  
2 geographic addressing which is part of the 02:27:16  
3 configuration cycles. This is why I said 02:27:17  
4 configuration is a little bit different in each 02:27:20  
5 one. So the computer goes through every slot, 02:27:23  
6 every potential location for an I/O device and 02:27:26  
7 once it finds such a device, then it will check 02:27:30  
8 what is the amount of local memory I/O space the 02:27:34  
9 device has, collect all that information, then 02:27:38  
10 the BIOS creates an address map, based on some 02:27:41  
11 algorithm which is not disclosed, and then it 02:27:46  
12 goes back and writes to every individual PCI 02:27:48  
13 device, "This is now your base address on which 02:27:50  
14 you respond if there is ever a PCI transaction." 02:27:53  
15 And, of course, it's being made very sure that 02:27:56  
16 under no circumstances windows overlap because 02:27:59  
17 then you have two devices answering and the 02:28:03  
18 result is garbage. That means, and this is why I 02:28:06  
19 said earlier, without PCI configuration cycles 02:28:10  
20 you have nothing, you have a dead system. And 02:28:12  
21 that also means, taking into account now the 02:28:14  
22 Horst reference, you have a million possible 02:28:17  
23 nodes and each of those million nodes could have 02:28:20  
24 several tens of possible PCI devices depending on 02:28:25  
25 the complexity of the PCI tree, this what is 02:28:28

1	called device war would have to be done across	02:28:31
2	all these devices and it could only be done by	02:28:34
3	one because the address map is something which is	02:28:37
4	seen centric to one processor. So the entire PCI	02:28:42
5	architecture basically assumes there is one	02:28:45
6	processor at the top which defines the address	02:28:48
7	map. And even today in multiprocessor computers	02:28:50
8	it's exactly like that.	02:28:54
9	Q. The patent, both patents, give	02:29:12
10	examples of different ways of transmitting PCI	02:29:15
11	bus transaction in a serial form, we were looking	02:29:21
12	at 13, 14 and 15, Figures 13, 14, 15, right?	02:29:26
13	MR. DAVIS: Objection to form.	02:29:32
14	BY MR. BUROKER:	02:29:32
15	Q. For example.	02:29:32
16	A. Which patent?	02:29:34
17	Q. '814.	02:29:36
18	A. Okay, let me just pull this out.	02:29:38
19	Q. 13, 14 and 17, sorry.	02:29:43
20	A. You mean 13A and B?	02:29:51
21	Q. Actually, you know what, I think	02:29:53
22	it's the '873 Patent.	02:29:54
23	So, yeah, your paragraph 80 earlier, we	02:30:08
24	were looking at Figures 13 and 14 of the '873	02:30:12
25	Patent.	02:30:17

1	A. Yes.	02:30:17
2	Q. And then Figure 17 of the '814	02:30:17
3	Patent.	02:30:22
4	A. Yeah, these are just the	02:30:22
5	differential signals, right, the 17. Yeah.	02:30:29
6	Q. Well, 17 is showing what would be	02:30:33
7	used to generate the signals on the serial line,	02:30:38
8	right?	02:30:42
9	A. The clock and the four signals	02:30:43
10	conveying the actual ...	02:30:46
11	Q. Right, that would be a five-wire	02:30:49
12	system, and since there are five wires and	02:30:50
13	there's way more bits than that, that makes it	02:30:52
14	a serial transmission in your view; is that	02:30:56
15	correct?	02:30:58
16	A. Yeah, according to the definition	02:30:58
17	I set forth.	02:31:03
18	Q. Okay. And doesn't the	02:31:04
19	specification also say that the XP bus, which is	02:31:05
20	the serial bus in the patent, can use IEEE 1394?	02:31:11
21	MR. DAVIS: Objection; form.	02:31:20
22	THE WITNESS: Now, where does it say?	02:31:25
23	Where are we referring to and which patent?	02:31:27
24	BY MR. BUROKER:	02:31:31
25	Q. So '814, column 22, lines 7 to 8.	02:31:31

1	A.	Column 2 you're saying?	02:32:05
2	Q.	Column 22.	02:32:07
3	A.	Sorry.	02:32:08
4	Q.	Yes.	02:32:37
5	A.	Yeah, I see that. I mean	02:32:37
6		basically what it says here is what we have here	02:32:40
7		is one way of communicating signals in a very	02:32:43
8		efficient and fast way, and this is not limited	02:32:46
9		to PCI itself, yeah.	02:32:49
10	Q.	Right. So starting at column 22,	02:32:59
11		line 4, it says that:	02:33:01
12		"The XP Bus lines, PD0 to PD3, PCN,	02:33:02
13		PDR0 to PDR3 and PCNR, and the video data and	02:33:15
14		clock lines, VPD and VPCK, are not limited to	02:33:20
15		being LVDS lines, as they may be other forms of	02:33:26
16		bit based lines. For example, in another	02:33:29
17		embodiment the XP Bus lines may be IEEE 1394	02:33:32
18		lines."	02:33:38
19		Right? That's saying that the bits	02:33:38
20		that are used to transmit the serial form of the	02:33:42
21		PCI bus can be IEEE 1394, FireWire line?	02:33:47
22	MR. DAVIS:	Objection; form.	02:33:55
23	THE WITNESS:	Do you have the 1394	02:33:58
24		standard right handy?	02:34:15
25	BY MR. BUROKER:		02:34:19

1	Q. I don't know that I do. You're	02:34:19
2	familiar with it obviously.	02:34:21
3	A. Sure.	02:34:21
4	Q. And what is it generally?	02:34:23
5	MR. DAVIS: Objection to form.	02:34:27
6	BY MR. BUROKER:	02:34:29
7	Q. I don't have a copy.	02:34:30
8	A. This evolved from the SCI	02:34:34
9	standards. Dave James, one of the main authors	02:34:38
10	of SCI, was also on the FireWire 1394 Committee I	02:34:41
11	believe when he still was working for Apple. The	02:34:46
12	reason why I wanted to have a quick look is to	02:34:48
13	refresh my mind about the exact physical	02:34:51
14	signalling definition in 1394.	02:34:53
15	The point here is obviously about the	02:35:02
16	definition, what is LVDS. And there is, on one	02:35:08
17	hand, the IEEE 1596.3 standard, which is, I	02:35:16
18	believe, the first incarnation of LVDS. In fact	02:35:25
19	that was just when I arrived in the U.S. as	02:35:31
20	a post-doc I was even part of that working group	02:35:33
21	and I saw the very first LVDS chips of national	02:35:35
22	semiconductors ever to exist, and they were	02:35:40
23	defined in the 1596.3 standard, a substandard of	02:35:42
24	SCI. Later, slightly different versions were	02:35:48
25	created, and I believe the patent says clearly	02:35:55

1	that in case of LVDS being cited they mean	02:35:58
2	generic low-voltage differential signals. So the	02:36:04
3	bottom line is, for example, 1596.3 says the	02:36:07
4	midpoint of that signal has to be at 1.2 volt and	02:36:12
5	the signal is, I believe, a one milliamperere	02:36:15
6	signal, so if you want to move it to 1.5 volts it	02:36:19
7	wouldn't be LVDS any more according to 1596.3	02:36:22
8	but, from the context, from the logical meaning	02:36:26
9	-- what is low-voltage differential very	02:36:29
10	high-speed signals -- it would still be the same	02:36:36
11	thing.	02:36:38

12	So what they try to say here is, in my	02:36:38
13	understanding, if a slight variation of the	02:36:43
14	physical signalling from the original standard,	02:36:45
15	it would still work the same way, it would still	02:36:51
16	make sense.	02:36:56

17 I'm trying to find now the definition in 02:36:57  
18 this patent, how they interpret LVDS, but I'm 02:36:59  
19 very sure there is a definition and it says that. 02:37:02

20 Q. Well, in paragraph 81 of your '814 02:37:08

21 declaration, it says: 02:37:13

22	"The '873 patent discusses serial lines	02:37:21
23	and serial packet protocols and uses LVDS IEEE	02:37:24
24	1394 (FireWire) and Universal Serial Bus ... as	02:37:29
25	examples."	02:37:33



1                   And then you cite to the '814 Patent                   02:37:34  
2                   column 22, 26 to 30. I don't know if that's               02:37:37  
3                   helpful.   02:37:44  
4                   And then it says:   02:37:45  
5                   "... LVDS encodes serial bits as                           02:37:48  
6                   voltage differences onto opposed lines such as in       02:37:51  
7                   Figure 15 of the '873 patent."                               02:37:54  
8                   A. You got me lost, I wasn't fast                       02:37:56  
9                   enough for you. Which page are we now?                   02:37:59  
10                  Q. Paragraph 81, page 49.                               02:38:01  
11                  A. '814, 22, 26 to 30. Yeah, I mean                   02:38:59  
12                  here they also say they are examples but they           02:39:12  
13                  don't limit themselves to any particular special       02:39:15  
14                  incarnation.   02:39:20  
15                  Q. Does IEEE 1394 support 32-bit PCI                   02:39:22  
16                  flat addressing?   02:39:30  
17                  A. Now, I would really like to look                   02:39:34  
18                  at that specification. Off the top of my head           02:39:35  
19                  this is a different thing and I would expect not,       02:39:37  
20                  but I would rather look at the specification.           02:39:42  
21                  Q. I don't have it, I apologize.                       02:39:46  
22                  A. Do we have it?                                       02:39:47  
23                  Q. I don't. And that's fair. As you                   02:39:48  
24                  sit here today, you don't know whether or not           02:39:59  
25                  IEEE 1394 supports the 32-bit PCI flat addressing       02:40:01

1 space or not. It may or may not, is that fair? 02:40:07

2 A. Yeah. 02:40:09

3 Q. Okay. Do you know whether IEEE 02:40:11

4 1394 can contain PCI standard addresses or 02:40:21

5 standard bus commands? 02:40:26

6 MR. DAVIS: Objection; form. 02:40:28

7 THE WITNESS: And I would again like to 02:40:32

8 refer to the specification. If I had a computer 02:40:33

9 I could pull it from the net real quick. 02:40:36

10 This is an SCI-like network, so 02:40:40

11 consequently, given the arguments I set forth 02:40:48

12 here, most likely they are the same. 02:40:52

13 BY MR. BUROKER: 02:40:57

14 Q. So you say "set forth here", your 02:40:57

15 hand is on your declaration, meaning the 02:40:59

16 arguments you made about SCI in your declaration 02:41:01

17 about why it doesn't meet the claims you would 02:41:03

18 think that IEEE 1394 doesn't meet the claims? 02:41:07

19 A. Yeah, but I mean I'm under oath 02:41:11

20 here, I really don't want to do too much 02:41:16

21 speculation and although I am obviously quite 02:41:18

22 familiar with FireWire, I would rather stick to 02:41:26

23 the documents and if we can't have them it's 02:41:30

24 going to be a bit too much vague, I think. 02:41:31

25 MR. BUROKER: Okay. I may come back to 02:41:36

1           it, I can always print at some later time or for           02:41:38  
2           tomorrow, so we'll see.           02:41:43  
3                    I need to take a break right now           02:41:45  
4           though. Can we go off the record?           02:41:47  
5                    (Brief recess taken 2:41 p.m. - 2:51 p.m.)           02:41:48  
6           BY MR. BUROKER:           02:51:53  
7                    Q.    So, paragraph 82 of your           02:51:55  
8           declaration -- it may be even on the same page,           02:51:57  
9           great -- you talk about one of the advantages of           02:52:01  
10          the patented system is that, in the second           02:52:12  
11          sentence you say:           02:52:18  
12                    "... no new drivers are needed to           02:52:19  
13          ensure the peripherals work on the system."           02:52:22  
14                    Do you see that?           02:52:24  
15                    A.    Absolutely, yes.           02:52:25  
16                    Q.    Okay. So, as you read the '814,           02:52:26  
17          and '873 Patents, did the inventor create any           02:52:34  
18          additional drivers or not?           02:52:43  
19                    A.    I believe they even make the point           02:52:44  
20          this is not necessary and this is a big advantage           02:52:46  
21          because otherwise the ACM couldn't use any           02:52:49  
22          generic device being connected to the console           02:52:56  
23          where it's plugged in. Now let me see if I can           02:53:00  
24          find this quickly. Probably you know this even           02:53:02  
25          better than me, but it's definitely in -- I           02:53:04

1 believe it's in both of them. 02:53:08

2 Q. Well you cite in your declaration 02:53:10

3 to the '873 Patent at column 4, lines 50 to 58. 02:53:12

4 A. So I should just read my own 02:53:20

5 declaration and use the references right there. 02:53:22

6 Yeah, I think the relevant sentence 02:54:18

7 would be: 02:54:20

8 "The invention also can be implemented 02:54:21

9 without changes in operating system and 02:54:23

10 application software." 02:54:26

11 Now, that clearly means device drivers 02:54:28

12 because they're part of the operating system and 02:54:31

13 being loaded on demand depending on in fact PCI 02:54:34

14 configuration cycle. 02:54:40

15 Q. Looking now at the claims we've 02:54:44

16 been looking at, take for example claim 24 of the 02:54:48

17 '814, is there anything in the claim that says 02:54:52

18 you can't have new drivers or that, you know, the 02:54:58

19 system has to be interoperable with existing 02:55:02

20 software? 02:55:06

21 MR. DAVIS: Objection; form. 02:55:11

22 THE WITNESS: I just read it again to 02:55:13

23 be really sure. It doesn't say explicitly, but 02:55:45

24 since we have the transmission of encoded PCI bus 02:55:52

25 transactions, that means the PCI infrastructure 02:55:59

1 is maintained and that would have a direct 02:56:06  
2 consequence. But it's not an explicitly stated 02:56:10  
3 requirement of claim 24. 02:56:18  
4 BY MR. BUROKER: 02:56:18  
5 Q. Okay. And then your declaration 02:56:20  
6 also makes mention about the fact that there is 02:56:22  
7 no need for any new hardware; is that correct? 02:56:27  
8 A. In what context? 02:56:37  
9 Q. Well, in paragraph 97 and 98, one 02:56:43  
10 of the points you make about the difference 02:56:58  
11 between the patented invention and the TNet 02:57:01  
12 system is that the TNet required new hardware to 02:57:04  
13 operate; is that correct? 02:57:07  
14 A. Yeah, correct. 02:57:09  
15 Q. Is there anything in claim 24 of 02:57:10  
16 the '814 Patent that excludes the addition of new 02:57:13  
17 hardware? 02:57:18  
18 A. There is no statement about that 02:57:27  
19 in this claim. 02:57:30  
20 Q. And what about 31 of the '814 02:57:32  
21 Patent? 02:57:34  
22 A. Same here, no explicit language, 02:57:58  
23 although since we are conveying complete PCI bus 02:57:59  
24 transactions it would be implicitly the case. 02:58:05  
25 Why build it? There's no need to build 02:58:08

1 additional hardware to generate the PCI 02:58:13  
2 transactions, because it's already here, this is 02:58:15  
3 the point I'm trying to make, all right? In this 02:58:17  
4 case PCI bus transactions are communicated over 02:58:20  
5 these kind of channels, it is spelt out in 02:58:23  
6 slightly different forms, but it's always the 02:58:27  
7 same basic principle, enabling the receiving 02:58:29  
8 device to produce that particular piece of 02:58:36  
9 transaction completely transparently to hardware 02:58:40  
10 and software. Therefore there is no need to do 02:58:45  
11 anything else. In case -- 02:58:48  
12 Q. Well if the -- I'm sorry. 02:58:49  
13 A. In case of both SCI and TNet, 02:58:51  
14 there is an entirely radically different topology 02:58:54  
15 in architecture and for it to interface to PCI 02:59:00  
16 one has to have a particular device creating such 02:59:04  
17 PCI transactions based on some macro commands 02:59:07  
18 being sent over that network. 02:59:09  
19 Q. But even the invention 02:59:12  
20 contemplates some additional hardware; there's 02:59:16  
21 the hardware that serializes the PCI bus 02:59:18  
22 transaction. That's a new piece of hardware, 02:59:21  
23 right? 02:59:23  
24 A. That is correct. 02:59:23  
25 Q. So what did you mean by saying 02:59:24

1	that unlike the invention TNet requires new	02:59:25
2	hardware?	02:59:30
3	MR. DAVIS: Objection; form.	02:59:32
4	THE WITNESS: Now, let me just check,	02:59:38
5	are we discussing here in context of TNet or in	02:59:46
6	context of SCI? I think this is TNet, right?	02:59:50
7	BY MR. BUROKER:	02:59:56
8	Q. Correct.	02:59:56
9	A. Right, so these interfaces here	02:59:57
10	have to have quite a bit of functionality, there	03:00:02
11	is no direct obvious one-to-one A-B-C-D kind of	03:00:06
12	path as to how they are to be built. They have	03:00:13
13	to be able to execute all the specified PCI	03:00:16
14	transactions on the remote PCI bus, but these	03:00:21
15	transactions do not exist inside the TNet system	03:00:24
16	area network. There is on top of that an address	03:00:28
17	translation which needs to be done in the peer	03:00:31
18	system, let alone it being initialized and	03:00:35
19	everything. For it to be performing there is	03:00:39
20	typically a very large complexity of additional	03:00:43
21	functionality needed for this to make any sense.	03:00:47
22	So this is a highly complex ASIC.	03:00:51
23	What is outlined in this patent is	03:00:57
24	complex also, but we are basically serializing	03:00:59
25	the particular ongoing PCI transaction which is	03:01:03

1	being then made parallel on the far end again.	03:01:05
2	This is a different thing, there is no address	03:01:09
3	translation for instance involved and all the	03:01:11
4	other things. We can go into details here, if	03:01:12
5	you want, to make this more clear.	03:01:15
6	Q. But my -- strike that.	03:01:23
7	My question was more, on paragraph 97,	03:01:25
8	for example, it talks about avoiding the	03:01:27
9	requirement imposed by TNet of designing new bus	03:01:34
10	interface devices and new device drivers, but do	03:01:40
11	you agree that to implement the '814 patent you	03:01:43
12	still have to create a new hardware system to	03:01:50
13	serialize the PCI bus transaction on one end and	03:01:53
14	then interpret it on the other to output the PCI	03:01:56
15	bus transaction on the receiving end, right?	03:02:01
16	MR. DAVIS: Objection; form.	03:02:03
17	THE WITNESS: The '814 Patent outlines	03:02:06
18	how to build the serializer, this is correct.	03:02:14
19	BY MR. BUROKER:	03:02:14
20	Q. So there is some new piece of	03:02:17
21	hardware, software, whatever it is, the	03:02:18
22	serializer is something new?	03:02:20
23	A. Not software, hardware.	03:02:21
24	Q. So in the '814 Patent the patent	03:02:51
25	talks about the host interface controller and	03:02:57



1           then the peripheral interface controller, the HIC           03:03:00  
2           and the PIC, are you familiar with those?           03:03:04  
3                   A.    Uh-huh, let me just pull it.           03:03:08  
4           Okay, here we are.           03:03:10  
5                   Q.    So those are not off-the-shelf           03:03:15  
6           components, correct?           03:03:18  
7                   A.    Now, let me just see where exactly           03:03:21  
8           are we talking to?           03:03:24  
9                   Q.    Well they talk about them quite           03:03:27  
10          a bit in the patent, so the HIC and the PIC.           03:03:28  
11                  A.    Just to start at some particular           03:03:35  
12          reference to be on the same page.           03:03:42  
13                  Q.    Which patent are you looking at?           03:03:44  
14                  A.    '814. Didn't you say '814?           03:03:46  
15                  Q.    That's fine. So they're shown in           03:03:49  
16          Figure 7 is one place. And they're in 21 and 22,           03:03:52  
17          they're in a number of places.           03:04:16  
18                  A.    My '814 patent doesn't have           03:04:18  
19          a Figure 7. 3, 4, 5, 5A, 6, 8.           03:04:20  
20                  Q.    Oh you know what, I was looking at           03:04:26  
21          the '873, I apologize. Let me look at the '814.           03:04:28  
22                  So if you look at Figure 15, for           03:04:55  
23          example, the top section is the host interface           03:04:58  
24          controller and the bottom section is the           03:05:00  
25          peripheral interface controller.           03:05:03

1	A. Okay.	03:05:12
2	Q. So the question is: those are not	03:05:13
3	described as being off-the-shelf components in	03:05:15
4	this patent, are they?	03:05:18
5	A. No. In particular, I mean, the XP	03:05:22
6	bus is part of the patent, so this is something	03:05:25
7	novel.	03:05:28
8	Now, I can't tell whether or not Acqis	03:05:30
9	decided to make those commercial products and	03:05:34
10	sell them off the shelf, so from that point of	03:05:36
11	view I can't answer the question. But it's	03:05:38
12	certainly not a generic something.	03:05:41
13	Q. Right. So, in other words to make	03:05:43
14	at least the embodiments disclosed in this figure	03:05:45
15	work they had to create a host interface	03:05:50
16	controller, the XP bus and a peripheral interface	03:05:54
17	controller, so three pieces of hardware, right?	03:05:58
18	A. There is quite a bit of similarity	03:06:02
19	between these tools, so it's probably two	03:06:04
20	versions of one common reference, right? I mean	03:06:06
21	the bus controller, which is a bi-directional	03:06:08
22	bus, will be mostly the same except for the clock	03:06:12
23	generation, which is detailed in here, the PCI	03:06:15
24	interface is the same anyway. So from that point	03:06:21
25	of view they are rather similar but, yes, they	03:06:23

1	are different devices which are needed for this	03:06:26
2	communication to happen.	03:06:28
3	Q. So like TNet, where you had to	03:06:34
4	create additional hardware, this invention also	03:06:37
5	contemplates creating additional hardware in	03:06:40
6	order to send the PCI bus transaction in serial	03:06:43
7	form, right?	03:06:47
8	A. This invention transmits PCI	03:06:52
9	transactions in serial form, TNet does not.	03:06:57
10	Q. Right, but this invention, in	03:06:59
11	order to do so, had to create new hardware to	03:07:01
12	make that possible?	03:07:03
13	A. I agree with that.	03:07:05
14	Q. Right, you've got the Horst/TNet	03:07:13
15	reference in front of you?	03:07:17
16	A. Horst/TNet, here we are.	03:07:27
17	Q. So one of the things you say in	03:07:55
18	your declaration, and in particular -- and I'll	03:07:57
19	give you the paragraph number -- is that the TNet	03:07:59
20	bus interface in the console generates a PCI bus	03:08:03
21	transaction; is that correct.	03:08:11
22	A. Where is that?	03:08:13
23	Q. Paragraph 133.	03:08:15
24	A. And we are still --	03:08:16
25	Q. Oh '814 declaration,	03:08:17

1	paragraph 133.	03:08:20
2	A. Right:	03:08:37
3	"The TNet bus interface then uses its	03:08:37
4	knowledge of the PCI bus and the PCI bus protocol	03:08:40
5	... to generate a PCI bus transaction on the PCI	03:08:44
6	bus."	03:08:47
7	Q. Maybe it's easier if we just walk	03:08:49
8	through your understanding of how something would	03:08:52
9	work.	03:08:57
10	So looking at Figure 2 of the Horst	03:09:01
11	reference. Okay, so what is shown there is CPU	03:09:07
12	memory boxes up top. Those are what EMC contends	03:09:14
13	to be the modules, correct?	03:09:24
14	MR. DAVIS: Objection; form.	03:09:27
15	BY MR. BUROKER:	03:09:30
16	Q. In the claim there is an ACM	03:09:30
17	module, an ACM?	03:09:33
18	A. Yeah, I very well remember that.	03:09:36
19	We're talking the '814 here, right?	03:09:38
20	Q. Uh-huh.	03:09:42
21	A. So let me just pull this up	03:09:43
22	because I believe the definition of the ACM is in	03:09:46
23	the claim and it required a bit more than just	03:09:48
24	CPU and memory. And, I mean, this is a very,	03:09:50
25	very high-level diagram, so one has to be always	03:09:56

1 careful with these high abstraction levels. One 03:09:59  
2 can interpret a lot into them which may not 03:10:02  
3 really be there at the end. 03:10:06  
4 So let me just check. 03:10:07  
5 "... the console comprising a first low 03:10:15  
6 voltage differential signal channel ... 03:10:18  
7 comprising two unidirectional serial channels 03:10:20  
8 that transmit encoded data of ... (PCI) bus 03:10:22  
9 transaction in opposite directions; said ACM 03:10:25  
10 comprising a microprocessor unit ... a mass 03:10:29  
11 memory storage device ..." 03:10:31  
12 Which is not here on top of Figure 2: 03:10:32  
13 "... a north bridge to communicate 03:10:38  
14 address and data bits of PCI ..." 03:10:39  
15 Neither a northbridge is shown here nor 03:10:41  
16 PCI is shown here. In fact it is shown that 03:10:45  
17 these two links go to two apparently different, 03:10:47  
18 possibly redundant, TNet sub-nets and that 03:10:54  
19 clearly rules out PCI to be there. 03:10:59  
20 "... a main memory coupled to said 03:11:02  
21 processor unit through said north bridge ..." 03:11:04  
22 Now here's the limitation that the main 03:11:07  
23 memory has to be coupled to the CPU through the 03:11:08  
24 northbridge, there's no northbridge shown but, 03:11:11  
25 again, at this abstraction layer it could have 03:11:12

1           been just omitted. It wouldn't be something           03:11:15  
2           extremely uncommon to use a northbridge. A           03:11:19  
3           second LVDS channel, again to communicate PCI bus           03:11:23  
4           transaction. So, taking claim 24 as the first           03:11:29  
5           big independent claim of that patent, I would say           03:11:34  
6           this cannot be an ACM.           03:11:36  
7                   Q. Looking at Figure 7 then, which is           03:11:38  
8           a little bit of a more blown up or detailed view           03:11:43  
9           of the various components.           03:11:47  
10                  A. Okay.           03:11:49  
11                  Q. Let's just suppose that that RISC           03:11:54  
12           CPU wants to talk to a PCI device that's           03:11:58  
13           connected to the TNet links and the PCI device           03:12:13  
14           would be something hanging off the bottom of           03:12:17  
15           what's shown in Figure 8.           03:12:19  
16                  MR. DAVIS: Objection; form.           03:12:24  
17                  THE WITNESS: Now careful; Figure 8 is           03:12:34  
18           VME.           03:12:37  
19           BY MR. BUROKER:           03:12:40  
20                  Q. No, Figure 8 says it can be           03:12:41  
21           connected to a 32-bit bus which can be VME,           03:12:43  
22           Motorola 68040 or PC -- it says PCL but it's           03:12:51  
23           referring to PCI.           03:12:54  
24                  MR. DAVIS: Objection to form.           03:12:55  
25                  THE WITNESS: You mean this is a typo?           03:12:56

1	BY MR. BUROKER:	03:12:58
2	Q. Yes.	03:12:58
3	A. A typo?	03:12:58
4	Q. You can go to the text, if you	03:12:59
5	like, just to the left of that. The text says:	03:13:00
6	"Figure 8 shows a block diagram of the	03:13:03
7	TNet bus interface (TBI) ASIC. The TBI	03:13:05
8	translates transfers on the standard bus into	03:13:12
9	TNet read or write transactions that travel	03:13:14
10	through TNet links to main memory.	03:13:17
11	"Different versions of the bus	03:13:18
12	interface logic support industry standard buses	03:13:20
13	such as VME and the peripheral component	03:13:24
14	interconnect (PCI), or microprocessor buses such	03:13:27
15	as that of the Motorola 68040 chip."	03:13:32
16	Do you see that?	03:13:36
17	A. Okay.	03:13:38
18	Q. So that "PCL" is a typo. It	03:13:38
19	should be "PCI".	03:13:40
20	MR. DAVIS: Objection; form.	03:13:40
21	BY MR. BUROKER:	03:13:40
22	Q. Do you agree?	03:13:41
23	MR. DAVIS: Objection; form.	03:13:42
24	THE WITNESS: Given that the text	03:13:49
25	clearly describes that, then I would take this as	03:13:52

1 a high-level diagram which says there are 03:13:57  
2 different versions of this obviously, which 03:14:01  
3 probably have different bus interfaces sitting 03:14:03  
4 next to each other on that ASIC in order to 03:14:07  
5 generate the particular type of bus transaction 03:14:13  
6 required. 03:14:16  
7 BY MR. BUROKER: 03:14:17  
8 Q. Right. And looking back at 03:14:17  
9 Figure 2, it shows an example of one of those 03:14:19  
10 interfaces you're talking about, it shows a box 03:14:24  
11 that says "PCI interface", do you see that? 03:14:27  
12 A. Yes, at the right bottom. 03:14:30  
13 Q. So looking at the Figure 8 in 03:14:35  
14 combination with Figure 2, what you're saying is 03:14:38  
15 there would be a PCI interface box that would be 03:14:40  
16 attached to the long line in Figure 8. Is that 03:14:42  
17 correct? 03:14:48  
18 MR. DAVIS: Objection; form. 03:14:49  
19 THE WITNESS: There would be a PCI 03:14:57  
20 interface connected to this bus line, the long 03:14:59  
21 line as you call it, drawn in Figure 8, yeah. 03:15:03  
22 Assuming that "PCL" is a typo, correct. 03:15:07  
23 BY MR. BUROKER: 03:15:15  
24 Q. And then connected to that PCI bus 03:15:15  
25 interface would be potentially one or more PCI 03:15:19



1	devices?	03:15:22
2	A. Correct.	03:15:22
3	Q. So both Figure 7 and Figure 8	03:15:30
4	refer to or point to this thing that says TNet	03:15:34
5	links?	03:15:38
6	A. Correct.	03:15:39
7	Q. So the idea is that what's shown	03:15:40
8	in Figure 7 would connect to the TNet links to	03:15:42
9	what is shown at Figure 8. Is that the right way	03:15:46
10	to read this?	03:15:49
11	MR. DAVIS: Objection; form.	03:15:50
12	THE WITNESS: I mean TNet is a defined	03:15:52
13	protocol here and now I purposefully avoid the	03:15:56
14	word "standard" because, you know, it's	03:16:00
15	proprietary I assume. But it's defined, at least	03:16:04
16	within the context of this document, and so TNet	03:16:08
17	link in Figure 8 would have to be the same thing	03:16:12
18	as TNet link in Figure 7 and they would have to	03:16:16
19	be interoperable for this to make any sense.	03:16:20
20	BY MR. BUROKER:	03:16:20
21	Q. And then what's shown in Figure 2,	03:16:23
22	those long rectangles, are described as TNet	03:16:26
23	links in the document.	03:16:29
24	THE WITNESS: Careful, this is --	03:16:31
25	MR. BUROKER: Is that right?	03:16:33

1                   MR. DAVIS:  Objection; form.                   03:16:34

2                   THE WITNESS:  -- this is the TNet               03:16:36

3                   system area network, where the TNet links are       03:16:39

4                   only a small fraction of.  The link is basically     03:16:42

5                   just the way to connect to the system, and I mean     03:16:46

6                   the network system here.                   03:16:52

7                   Again, also here, we are talking very           03:16:56

8                   fast links which are point-to-point.  So in order     03:16:59

9                   to be able to have a large number of particular     03:17:03

10                  devices talking to each other, typically with       03:17:06

11                  lots of processors, there has to be some kind of     03:17:08

12                  a network, with switches, routers and everything.   03:17:11

13                  Figure 9 gives a rough outline of this.  And the     03:17:15

14                  fact that Figure 2 shows two different networks     03:17:18

15                  here, X and Y, indicates that there is           03:17:24

16                  a redundancy in the network, allowing packets to     03:17:33

17                  travel different paths from source destination,     03:17:36

18                  which is something people like to do in order to     03:17:40

19                  have flexibility and in order to avoid           03:17:45

20                  congestion, taking the B path if A is overloaded,   03:17:52

21                  which has lots of highly complex ramifications.     03:17:56

22                  So in here is a rather complex networking in       03:17:58

23                  between.  You see in Figure 9 six routers being     03:18:03

24                  drawn.  Whatever number there is depends on the     03:18:06

25                  architecture of the switching technology being     03:18:12

1 developed for TNet, but there is absolutely 03:18:14  
2 nothing disclosed, if I remember correctly, 03:18:17  
3 inside this document as to how these switches 03:18:21  
4 would really work in detail, except for this very 03:18:23  
5 high-level diagram in Figure 6. Which is 03:18:29  
6 a diagram which is basically valid for every kind 03:18:34  
7 of switch in any kind of networking standard. 03:18:36  
8 BY MR. BUROKER: 03:18:36  
9 Q. Okay. So one configuration is 03:18:43  
10 possible to have a single -- to have the elements 03:18:51  
11 of Figure 7 connected directly over TNet links to 03:18:57  
12 what's shown in Figure 8 and then have Figure 8 03:19:05  
13 connected to a PCI bus interface which would be 03:19:10  
14 connected to a PCI device? 03:19:14  
15 MR. DAVIS: Objection -- 03:19:18  
16 BY MR. BUROKER: 03:19:19  
17 Q. Is that right? 03:19:19  
18 MR. DAVIS: Objection; form. 03:19:20  
19 THE WITNESS: Honestly I can't tell. 03:19:22  
20 The reason is it depends really on a lot of 03:19:25  
21 details as how this network is being built. 03:19:33  
22 There are networks which do not allow direct 03:19:38  
23 node-to-node connection. Basically what you're 03:19:42  
24 saying do away without the switching and the 03:19:44  
25 infrastructure and do a point-to-point 03:19:47

1 connection, I understand that. Some networks 03:19:50  
2 allow doing that, some don't. Whether TNet 03:19:53  
3 supports this functionality is not disclosed in 03:19:56  
4 this document. 03:19:58  
5 BY MR. BUROKER: 03:19:58  
6 Q. So the fact that there's the word 03:20:01  
7 "TNet link" in Figure 8 and the word "TNet link" 03:20:03  
8 in Figure 7, you can't tell, is what you're 03:20:07  
9 saying, whether or not that means that they can 03:20:09  
10 be directly coupled together without more 03:20:11  
11 information? 03:20:13  
12 MR. DAVIS: Objection; form. 03:20:13  
13 THE WITNESS: "TNet link" only means 03:20:16  
14 the connection for the network, very 03:20:19  
15 oversimplifying the network cable. But I mean it 03:20:25  
16 is more, right, the entire definition of the 03:20:26  
17 standard, protocols, and so forth. Whether or 03:20:28  
18 not you can directly connect them it doesn't 03:20:32  
19 implicitly say. So at the time this was 03:20:37  
20 invented, for example, it was not possible to 03:20:41  
21 connect two computers with a twisted pair 03:20:45  
22 Ethernet cable. 03:20:53  
23 (The court reporter sought clarification.) 03:20:53  
24 THE WITNESS: Sorry, a twisted pair 03:20:53  
25 Ethernet cable. You had to have what is called 03:20:53

1 a crossover cable, where a couple of wires were 03:20:55  
2 changed. Now since this is not necessary these 03:21:00  
3 days anymore because the network devices in 03:21:03  
4 computers basically test which kind of cable is 03:21:07  
5 being plugged in and then they automatically 03:21:12  
6 electronically change internally. 03:21:14  
7 BY MR. BUROKER: 03:21:14  
8 Q. But would a person of skill in the 03:21:19  
9 art in '96, as you've defined it, be able to look 03:21:22  
10 at this document and determine how to connect 03:21:26  
11 what's shown in Figure 7 directly to Figure 8? 03:21:29  
12 MR. DAVIS: Objection to form. 03:21:34  
13 THE WITNESS: From the level of 03:21:40  
14 disclosure in this document, I, as expert, cannot 03:21:45  
15 tell whether this is possible, so a person of 03:21:47  
16 ordinary skill in the art I doubt would be able 03:21:49  
17 to tell. You know one could try and see whether 03:21:51  
18 it worked. 03:21:53  
19 BY MR. BUROKER: 03:21:56  
20 Q. Okay, but you agree that Figure 9 03:21:57  
21 shows an architecture in which the processor 03:22:02  
22 interface, which is the one shown in Figure 7, is 03:22:06  
23 connected via several routers to a bus interface 03:22:12  
24 which is what's shown in Figure 8? 03:22:18  
25 A. That's correct. 03:22:21

1                   Q.    And the bus interface in Figure 9                   03:22:23  
2                   could be a PCI bus interface, because that's one               03:22:26  
3                   of the examples that the text tells us can be               03:22:32  
4                   part of Figure 8, correct?                   03:22:36  
5                   A.    Correct, although in this case,                   03:22:38  
6                   SCSI is used as an example, yeah, there I agree.           03:22:42  
7                   Q.    So if you were going to have a PCI                   03:22:44  
8                   bus interface in Figure 9 then you would connect           03:22:49  
9                   it to one or more PCI devices and not one or more           03:22:52  
10                  SCSI devices, right?                   03:23:01  
11                  A.    Yeah.                   03:23:01  
12                  MR. BUROKER:   SCSI is S-C-S-I, all                   03:23:02  
13                  caps.                   03:23:02  
14                  THE COURT REPORTER:   Thank you.                   03:23:02  
15                  BY MR. BUROKER                   03:23:02  
16                  Q.    It's shorthand for -- what does                   03:23:04  
17                  "SCSI" stand for?                   03:23:06  
18                  A.    I believe "small computer system                   03:23:08  
19                  interface", but I wouldn't bet on it.   This is           03:23:10  
20                  a mass storage standard.                   03:23:14  
21                  Q.    Everybody just calls them SCSI.                   03:23:21  
22                  A.    Yeah.   It's a byte-wide kind of                   03:23:24  
23                  bus.                   03:23:30  
24                  Q.    So with that in mind, if you have                   03:23:31  
25                  the Figure 7 RISC CPU, you place that in as               03:23:33

1 connected to the processor in Figure 9. You have 03:23:44  
2 in mind what I'm talking about? 03:23:46

3 A. Yes, you're trying to replace the 03:23:48  
4 top three -- top two boxes. 03:23:49

5 Q. Uh-huh. 03:23:52

6 A. One being CPU memory and the other 03:23:53  
7 being processor interface with -- 03:23:55

8 Q. What's in Figure 7. 03:23:57

9 A. -- what's in Figure 7, yeah. 03:23:58

10 Q. So if you had that, and that RISC 03:24:00  
11 CPU wanted to communicate to a PCI device in the 03:24:04  
12 example where the bus interface is a PCI bus 03:24:09  
13 interface and then, instead of SCSIIs, you've got 03:24:12  
14 a PCI device connection, correct? 03:24:15

15 A. Yeah. 03:24:17

16 Q. And in that situation then the bus 03:24:20  
17 interface would be what's shown in Figure 8 as 03:24:28  
18 the TNet bus interface and then the line would be 03:24:31  
19 a PCI line and there would be a PCI device 03:24:36  
20 connected to that? So you got that scenario in 03:24:42  
21 mind? 03:24:45

22 A. (The witness nodded.) 03:24:45

23 Q. Okay. If this RISC CPU wanted to 03:24:46  
24 do a write transaction to that PCI device -- 03:24:58

25 A. Uh-huh. 03:25:04

1                   Q.    -- what information would it send                   03:25:06  
2                   to the processor interface?                   03:25:09  
3                   MR. DAVIS:  Objection; form.                   03:25:13  
4                   THE WITNESS:  With "processor                   03:25:18  
5                   interface" you mean the system bus in Figure 7,                   03:25:20  
6                   for instance, right?                   03:25:23  
7                   BY MR. BUROKER:                   03:25:24  
8                   Q.    It would be the ... well, yeah, it                   03:25:24  
9                   would be the system bus interface that is part of                   03:25:30  
10                  the TNet processor interface in Figure 7, right.                   03:25:33  
11                  That whole grey area is the TNet processor                   03:25:39  
12                  interface according to this diagram.                   03:25:44  
13                  A.    Yeah, yeah, I understand that very                   03:25:47  
14                  well.                   03:25:48  
15                  Q.    Right.                   03:25:49  
16                  A.    But here starts the problem.                   03:25:50  
17                  First of all, in order for the processor to talk                   03:25:53  
18                  to any particular device, the processor has to                   03:25:57  
19                  know the physical address of that particular                   03:26:02  
20                  device as seen from its own local address space,                   03:26:06  
21                  right?  The processor lives in its own address                   03:26:15  
22                  space, which means potentially all one million                   03:26:19  
23                  processors inside TNet live in their own                   03:26:22  
24                  individual one million possibly different address                   03:26:25  
25                  spaces because they don't all have to be the                   03:26:26



1 same. So the fundamental question is what is the 03:26:29  
2 address of the particular PCI device connected to 03:26:33  
3 this TNet system, possibly having lots of such 03:26:39  
4 devices, as seen from the processor in this 03:26:44  
5 particular system at its particular system bus. 03:26:48  
6 Because the processor doesn't say, "I want to 03:26:52  
7 talk to the TNet interface", the processor says, 03:26:55  
8 "Here is an address" and then the rest of the 03:26:59  
9 system has to handle that. In order to get 03:27:01  
10 there, the PCI device first of all has to be 03:27:05  
11 initialized, right? When you switch it on it's 03:27:10  
12 dead, it says, "Leave me alone, I do not nothing 03:27:13  
13 but respond to PCI configuration cycles." Now, 03:27:15  
14 now this device has no way of directing any kind 03:27:19  
15 of PCI configuration cycles on the remote device 03:27:22  
16 of TNet. 03:27:25  
17 Q. When you say "this device" you're 03:27:26  
18 pointing at what? 03:27:28  
19 A. I'm pointing to the RISC CPU. 03:27:28  
20 Q. Go ahead? 03:27:28  
21 A. So for this to be initialized, 03:27:33  
22 which would be the first step prior to anything 03:27:36  
23 that could possibly happen, one has to understand 03:27:38  
24 how the people who developed that TNet-to-PCI 03:27:40  
25 interface conceived how this should happen. 03:27:45

1	There is no clear path to this solution, there	03:27:47
2	are many possible solutions. One example would	03:27:52
3	be, since you asked me as an expert in the field,	03:27:57
4	is that this interface has a variety of	03:28:01
5	particular configuration areas, and don't forget	03:28:06
6	the RISC CPU in Figure 7 of the TNet reference	03:28:12
7	has no way of generating a configuration cycle	03:28:16
8	for that matter; it just does its own processor	03:28:20
9	cycles, a completely different thing. Other bus,	03:28:24
10	other bus states, other everything. So it would	03:28:28
11	first of all know how to talk to the PCI	03:28:31
12	interface on the TNet site. That would require	03:28:35
13	the TNet system to be initialized, all the	03:28:38
14	address translation tables to be initialized, all	03:28:43
15	the nodes IDs of all nodes connected to TNet to	03:28:45
16	be given a unique address, nothing it disclosed	03:28:49
17	in here how this is possibly being done, and this	03:28:51
18	is a highly complex problem, again because at	03:28:55
19	this point in time there can only be one agent	03:28:59
20	reasonably distributing those addresses,	03:29:02
21	otherwise you have an address collision, very	03:29:05
22	simple, which triggers the question who is the	03:29:07
23	chosen one? There is a long paragraph about this	03:29:10
24	complexity in the SCI standard if you want to	03:29:13
25	read it.	03:29:16

1                   So you have to initialize first the                   03:29:16  
2           entire TNet system, set up all address                   03:29:19  
3           translation tables, have to define address                   03:29:21  
4           windows to reach the particular TNet nodes in                   03:29:23  
5           this particular case because the PCI-to-TNet                   03:29:30  
6           nodes have to be set up right. That would enable                   03:29:36  
7           then the RISC CPU to communicate via read and                   03:29:39  
8           write commands to the PCI-TNet interface, which                   03:29:44  
9           would show up somewhere in the address space, in                   03:29:47  
10          the physical address space of the RISC CPU in                   03:29:50  
11          Figure 7. This is the first step.                   03:29:54  
12                   Then the RISC CPU in Figure 7 would have                   03:29:56  
13          to communicate with the PCI-TNet interface                   03:30:00  
14          saying, "Actually I would like to do a PCI                   03:30:03  
15          cycle". And to start with it would have to be                   03:30:06  
16          a PCI configuration cycle and it would have to go                   03:30:08  
17          through all possible slots available. And for                   03:30:11  
18          every cycle it would get a response. Again there                   03:30:18  
19          is many different ways. One way is, for example,                   03:30:21  
20          that the particular PCI command is uploaded into                   03:30:23  
21          the interface to some defined subaddress space                   03:30:27  
22          and then by writing to some key address the                   03:30:31  
23          interface executes now this PCI transaction and                   03:30:34  
24          leaves the result in another register inside this                   03:30:37  
25          ASIC, and then the processor comes back again,                   03:30:40

1 reading this register saying, "What was the 03:30:43  
2 result of my command?" Right? So basically it 03:30:45  
3 would prepare the transaction that could be 03:30:49  
4 multiple write transactions to configure the 03:30:51  
5 device, and could also envision also solutions, 03:30:56  
6 but this is one example. 03:30:58

7 Now we have found there is a PCI device 03:31:00  
8 on that bus. The next step is run configuration 03:31:03  
9 cycles against the device to find out how much 03:31:05  
10 memory the device has in order to now map this in 03:31:07  
11 the context of the complete TNet address space 03:31:12  
12 and we have to keep in mind that the virtual 03:31:17  
13 addresses inside TNet have to be encoded on the 03:31:20  
14 -- have to be generated on the host site, so that 03:31:24  
15 the target device is properly received. 03:31:28

16 Once all of that has been done then 03:31:31  
17 there would be possibly a region in the address 03:31:35  
18 space of the RISC CPU, which would enable it to 03:31:40  
19 perform a write transaction which would then 03:31:45  
20 subsequently be captured by the TNet processor 03:31:50  
21 interface as shown in Figure 7. Now the CPU 03:31:57  
22 obviously knows the right addresses, it would 03:32:00  
23 then be translated by this TNet processor 03:32:02  
24 interface, the addresses would be converted into 03:32:06  
25 TNet addresses, this is a table lookup 03:32:10

1 particularly of this address translation logic 03:32:13  
2 shown in Figure 7 in the grey box. A packet 03:32:18  
3 would be generated, a TNet packet. There is some 03:32:20  
4 hint as to how the TNet packet looks like. The 03:32:24  
5 packet goes out, it percolates through the 03:32:27  
6 system, the routing devices know how to do this. 03:32:30  
7 At some point in time the packet is received by 03:32:33  
8 the PCI interface and then, if it's done right, 03:32:35  
9 one could implement something like that, and I 03:32:39  
10 have done this in the PCI-SCI adapter, except 03:32:43  
11 that the network is then SCI, that for a generic 03:32:47  
12 write executed by the CPU, an ordinary memory 03:32:53  
13 write of PCI would be executed. So one would 03:32:58  
14 basically allow a certain sub-functionality of 03:33:02  
15 PCI to be directly executed by the CPU for 03:33:05  
16 performance reasons, at the end of the day mostly 03:33:08  
17 will be probably reads and writes. All the other 03:33:10  
18 functionality is a complex initialization, 03:33:14  
19 configuration of these interfaces where the PCI 03:33:18  
20 interface here is not detailed. That would be 03:33:23  
21 part of the depacketizer functionality and 03:33:27  
22 a configuration space which is not explicitly 03:33:35  
23 shown. Every ASIC has a configuration space 03:33:37  
24 having this complexity. 03:33:40  
25 So it's far from being simple. And I 03:33:41

1           should also say I mean nothing of what I have           03:33:44  
2           just said is disclosed in this reference, I just           03:33:46  
3           responded like I would do something like that or           03:33:51  
4           some high-level person and we are far away from           03:33:54  
5           an ordinary-skill-in-the-art kind of person here,           03:33:57  
6           we are requiring system-level understanding of           03:34:00  
7           highly complex multi-parallel systems. We           03:34:02  
8           require the understanding routing algorithms and           03:34:05  
9           network deadlock resolution. These are all very           03:34:11  
10          complex subjects which have to be taken into           03:34:14  
11          account, otherwise the system will simply not           03:34:20  
12          work.           03:34:23  
13                   Q.    Let me unpack that a bit, that was           03:34:28  
14          a lot.           03:34:32  
15                   So looking at Figure 2, one of the           03:34:33  
16          things that is shown under the PCI interface is           03:34:38  
17          a PCI controller.           03:34:42  
18                   A.    Yes. Bottom right.           03:34:45  
19                   Q.    Is that a standard PCI device?           03:34:48  
20                   MR. DAVIS: Objection; form.           03:34:50  
21                   THE WITNESS: Again, I mean, this is           03:34:55  
22          a very high-level diagram, but it does say "PCI           03:34:56  
23          controller". And applying the definition we have           03:35:01  
24          been using, although I mean this is not a patent           03:35:06  
25          here, I would assume that if somebody uses the           03:35:09

1 words "PCI" -- which are well defined in industry 03:35:14  
2 -- then it's meant as a PCI as the PCI industry 03:35:17  
3 standard, and by that argument chain it would 03:35:23  
4 have to be a PCI-compliant device, correct. 03:35:26  
5 BY MR. BUROKER: 03:35:26  
6 Q. But does the term "controller" 03:35:30  
7 suggest that it is something different than a PCI 03:35:32  
8 device? Does the word "controller" mean anything 03:35:39  
9 to you in this context? 03:35:43  
10 A. I mean, we're here at 03:35:45  
11 10,000 meters flight height, right, trying to see 03:35:50  
12 little details. From this diagram I read we have 03:35:55  
13 a PCI interface connected to the network, TNet, 03:35:59  
14 and that means the primary path of communication 03:36:06  
15 here is the PCI interface connected to TNet. 03:36:09  
16 This is the particular ASIC we were discussing. 03:36:13  
17 The PCI controller, why it's being 03:36:17  
18 called "controller" I don't know and I don't want 03:36:21  
19 to guess, but it is a device which is compliant 03:36:23  
20 to PCI and this is even further emphasized by 03:36:25  
21 showing that there is written "PCI" to this 03:36:30  
22 single line interconnecting these two devices 03:36:34  
23 which to me says this is a PCI bus, compliant PCI 03:36:37  
24 bus. 03:36:42  
25 Q. So the PCI controller, you're not 03:36:46

1 familiar -- strike that. 03:36:51

2 Is there a thing in the PCI nomenclature 03:36:53

3 of -- strike that. 03:37:01

4 Could this be a processor that operates 03:37:04

5 to control all of the other devices on the PCI 03:37:08

6 bus? 03:37:11

7 MR. DAVIS: Objection; form. 03:37:15

8 THE WITNESS: Other devices on this 03:37:22

9 particular local PCI bus as shown in Figure 2? 03:37:24

10 BY MR. BUROKER: 03:37:32

11 Q. Yes. 03:37:32

12 A. PCI is a bus which allows multiple 03:37:36

13 masters to operate, so from that point of view 03:37:40

14 this could be almost anything, including 03:37:47

15 a processor. 03:37:49

16 Q. And it would be possible that that 03:37:51

17 processor is the one that does at least the 03:37:54

18 initialization stage that you talked about for 03:38:00

19 the other PCI devices, that wakes them up and 03:38:02

20 gives them their addresses on that PCI bus? 03:38:06

21 MR. DAVIS: Objection; form. 03:38:11

22 THE WITNESS: This is highly 03:38:15

23 constructed and from the -- I mean, this diagram 03:38:18

24 is part of a paper written by a senior in the 03:38:26

25 field, Robert Horst, he is Technical Director at 03:38:30



1 Tandem Labs, so obviously he has reached a 03:38:37  
2 relatively high level in his career and I would 03:38:40  
3 consider him an expert. 03:38:44

4 What they invented -- and they have 03:38:49  
5 quite a bit of discussion why they did that and 03:38:51  
6 what it is for -- was to develop TNet to enable 03:38:53  
7 a large number of computing devices, computer 03:38:57  
8 processors and memory -- and this is also 03:39:04  
9 indicated by the abstraction level here in 03:39:06  
10 Figure 2 where only CPU and memory is shown, not 03:39:08  
11 even any TNet interface -- to enable them to 03:39:11  
12 communicate very efficiently. 03:39:15

13 On top of that, of course such a large 03:39:17  
14 system has to have an interface to the outside 03:39:19  
15 world, otherwise it wouldn't make any sense, and 03:39:22  
16 for this reason all these additional devices, LAN 03:39:25  
17 controller, ATM controller, VME and PCI 03:39:34  
18 interfaces were created. To initialize such 03:39:37  
19 a highly complex system through a remote PCI 03:39:42  
20 interface to me would be taking the whole system 03:39:45  
21 upside down. What you would do is you would 03:39:50  
22 initialize the TNet system through the path for 03:39:52  
23 which you built it and that is the processors 03:39:55  
24 directly connected to it. There would have to be 03:39:58  
25 a mechanism to identify which is the one selected 03:40:00

1 to perform the first initialization, a large 03:40:06  
2 variety of different possible protocols possible, 03:40:11  
3 nothing disclosed here. And then the 03:40:14  
4 initialization would happen, and the PCI 03:40:17  
5 interface would be much more complicated if it 03:40:19  
6 would have to be built such that the 03:40:23  
7 configuration and this initialization could be 03:40:25  
8 done from the PCI side comfortably as well. I 03:40:27  
9 wouldn't do that at all as an expert. 03:40:30  
10 BY MR. BUROKER: 03:40:30  
11 Q. So, the same example I asked you 03:40:34  
12 about, if all of that were done, the 03:40:42  
13 initialization and so forth, then the flow that 03:40:47  
14 you describe just directionally would go from the 03:40:52  
15 RISC CPU through the TNet processor interface 03:40:56  
16 components? 03:41:01  
17 A. Uh-huh. 03:41:03  
18 Q. Next out onto the routers, one or 03:41:04  
19 more routers, until it reached the PCI bus 03:41:07  
20 interface that we've substituted for what's shown 03:41:12  
21 in Figure 9. 03:41:14  
22 A. Uh-huh. 03:41:15  
23 Q. And then the PCI bus interface 03:41:16  
24 would send it out on the PCI bus, something out 03:41:18  
25 on the PCI bus which would be received by the 03:41:24

1 appropriate PCI device; is that right? 03:41:28

2 MR. DAVIS: Objection; form. 03:41:30

3 THE WITNESS: After the proper 03:41:31

4 initialization has been done, which I outlined, 03:41:34

5 correct. 03:41:36

6 BY MR. BUROKER: 03:41:37

7 Q. And what you've said in your 03:41:37

8 declaration was that until whatever information 03:41:38

9 this is got to the PCI interface, it would not be 03:41:41

10 a PCI bus transaction and the PCI bus transaction 03:41:46

11 would be created at this PCI interface; is that 03:41:50

12 correct? 03:41:53

13 A. That is correct, yes. 03:41:53

14 Q. Okay. So would you agree that in 03:41:55

15 that situation the information received by the 03:41:58

16 PCI interface would have to contain all of the 03:42:03

17 information needed to create a PCI bus 03:42:07

18 transaction? 03:42:13

19 MR. DAVIS: Objection; form. 03:42:14

20 BY MR. BUROKER: 03:42:18

21 Q. That information would need to be 03:42:18

22 there in order for to create a PCI bus 03:42:20

23 transaction, correct. 03:42:23

24 MR. DAVIS: Objection to form. 03:42:25

25 THE WITNESS: I mean I realize this is 03:42:29

1 a very complicated subject and the answer is not 03:42:30  
2 easy. I believe I understand where you're trying 03:42:35  
3 to get to but it's not that simple. 03:42:40  
4 So, for example, we have to consider 03:42:43  
5 where we start and where we end, right? We start 03:42:47  
6 at the processor front side bus. And the 03:42:50  
7 processor has a certain set of functionality it 03:42:54  
8 can do. Most of that is cache coherency 03:42:59  
9 functionality which we absolutely don't care in 03:43:02  
10 the context of TNet even being put forward by 03:43:04  
11 Horst saying, "We don't need cache coherency in 03:43:08  
12 TNet" as opposed to SCI. There are 16 different 03:43:11  
13 PCI transactions possible. So the only thing 03:43:15  
14 that one can do or what people would try to do 03:43:21  
15 which I did in the PCI-SCI adapter for some 03:43:24  
16 performance, would be that if there is a certain 03:43:28  
17 write transaction arriving, what you get is 03:43:31  
18 an address, a virtual address in TNet land which 03:43:35  
19 is recognized by the PCI interface, translated to 03:43:37  
20 some other PCI address which has absolutely no 03:43:42  
21 relation to the physical address used by the 03:43:47  
22 processor at its front side bus, to then generate 03:43:51  
23 a pre-configured PCI transaction for this address 03:43:56  
24 range. So basically there is something 03:44:00  
25 prearranged saying, "Well if I write to this 03:44:04

1 address please do a memory write" or, "Please do 03:44:06  
2 a memory write multiple" or whatever other cycles 03:44:09  
3 one would have and that would have to be 03:44:13  
4 prearranged, could possibly even change over 03:44:16  
5 time. That makes this game even more complicated 03:44:18  
6 because usually it is very difficult to have 03:44:22  
7 multiple independent processors doing the same 03:44:24  
8 thing if you have a state, right? We call this 03:44:28  
9 a state because it has a context. And I'm trying 03:44:30  
10 to make it clear that you do not have, and you 03:44:34  
11 cannot have in this context, the complete 03:44:36  
12 information of the entire possible PCI context 03:44:40  
13 here in the far end as part of the network 03:44:45  
14 message going out. 03:44:49  
15 BY MR. BUROKER: 03:44:49  
16 Q. So, are you saying that it was not 03:44:51  
17 possible to build a PCI bus transaction in that 03:44:54  
18 it's just not possible to do because there's not 03:45:02  
19 enough information coming in from the CPU? 03:45:04  
20 A. No, no. As I said, you have 03:45:07  
21 pre-configured interface here -- 03:45:10  
22 Q. When you're saying "here" you're 03:45:13  
23 referring to -- 03:45:15  
24 A. Yes, you're right, pre-configured 03:45:15  
25 interface, and I'm pointing to the right. 03:45:18

1 Q. The PCI interface box in Figure 2? 03:45:21

2 A. Correct. 03:45:25

3 Q. Go ahead. 03:45:27

4 A. Which instructs it to respond to 03:45:28

5 certain TNet commands in a certain way. 03:45:32

6 Q. Okay. 03:45:35

7 A. Right? And obviously the 03:45:36

8 instruction is, "Generate a particular PCI 03:45:40

9 transaction upon this TNet command". But there 03:45:43

10 is no PCI transaction then on TNet nor is there 03:45:46

11 the PCI address on TNet. 03:45:52

12 Let me try to make it even -- show you 03:45:57

13 the complexity at the example of a read 03:46:00

14 transaction because that makes a couple of things 03:46:07

15 even more obvious. 03:46:08

16 Q. Well, let me ask one question and 03:46:09

17 then I'll let you do that. 03:46:11

18 What you're saying is that the PCI 03:46:11

19 interface would take some information that it 03:46:13

20 received through this flow from the CPU plus 03:46:16

21 information it already had and then could compose 03:46:21

22 a PCI bus transaction? 03:46:25

23 A. That is correct. 03:46:27

24 Q. Okay. So some but not all of the 03:46:28

25 information needed to create a PCI bus 03:46:32

1 transaction would come through from the CPU down 03:46:34  
2 through that flow to the PCI interface? 03:46:38  
3 A. For the given transaction. It 03:46:41  
4 would have to come through this flow via some 03:46:42  
5 other commands beforehand, yeah. 03:46:45  
6 Q. All right. 03:46:47  
7 A. Because the only path is here. 03:46:48  
8 Q. Right. So Figure 5 shows some 03:46:51  
9 idea of the addressing format for a TNet 03:47:07  
10 transaction; is that correct? 03:47:11  
11 A. Yes. 03:47:14  
12 Q. Okay. So I used the example of 03:47:15  
13 a write request that would be from the CPU. So 03:47:18  
14 according to this the write request would have 03:47:24  
15 four sections: the header; the 4-byte TNet 03:47:26  
16 address, which is referred to as the A; the D 03:47:31  
17 box, which is zero to 64 bytes of data; and then 03:47:36  
18 C which is the 4-byte CRC, which is basically 03:47:40  
19 a hash, right? 03:47:45  
20 A. It's an error correction. 03:47:47  
21 Q. Error correction. 03:47:47  
22 A. An error detection code, not 03:47:48  
23 correction, sorry, CRC cannot correct errors. 03:47:51  
24 Q. Error detection code, right. So 03:47:55  
25 there are four pieces of information that would 03:47:57

1	be part of what the CPU in that situation would	03:47:58
2	send down the pipe heading for the PCI, assuming	03:48:00
3	everything has been initialized as you said,	03:48:07
4	right?	03:48:10
5	A. Uh-huh.	03:48:11
6	Q. Why would you need both	03:48:21
7	a destination ID, which is in the header, and	03:48:23
8	a four-byte TNet address? Wouldn't the 20-bit	03:48:29
9	destination ID be sufficient to identify where	03:48:33
10	you wanted the packets of data to go on the TNet	03:48:37
11	network?	03:48:42
12	MR. DAVIS: Objection; form.	03:48:43
13	THE WITNESS: The answer is no. This	03:48:49
14	is a bit a question of semantics and how Horst	03:48:55
15	chose to present this. And I mean this is a nice	03:49:00
16	question because it nicely shows the fundamental	03:49:05
17	difference between the two scenarios we have	03:49:07
18	here. Now, I go to Figure 2, which I don't like	03:49:10
19	because it's so abstract but now it helps. At	03:49:18
20	the top you see three boxes saying "CPU" and	03:49:22
21	"memory".	03:49:25
22	BY MR. BUROKER:	03:49:25
23	Q. Uh-huh.	03:49:26
24	A. And my leftover 16 gigabytes of	03:49:27
25	memory, at that time one didn't have that much,	03:49:35



1 but 32 bits of address space is not that much for 03:49:37  
2 a CPU today. Even at that time computers were 03:49:41  
3 starting to have hundreds of megabytes of main 03:49:44  
4 memory. So the address space needed to simply 03:49:47  
5 address the memory, let alone to address anything 03:49:50  
6 outside that CPU, like the entire TNet world, is 03:49:53  
7 the address space the local CPU has and this 03:49:58  
8 other 32 bits, okay? And, for example, let's say 03:50:01  
9 the left CPU is CPU 1, the middle is 2 and the 03:50:09  
10 right one is 3. If CPU 1 wanted to read 03:50:14  
11 an address from CPU 3 it would have to say which 03:50:17  
12 address, and that would be an address of the 03:50:19  
13 entire possible address space of CPU 3. So in 03:50:22  
14 this context there would be 32 bits. Of course, 03:50:26  
15 all modulo address translation, but at the final 03:50:29  
16 end, when everything is said and done, that would 03:50:34  
17 have to be the correct physical address of that 03:50:36  
18 particular address in CPU 3. 03:50:38  
19 The same game I can play for CPU 2. And 03:50:41  
20 in parallel computing this is exactly what 03:50:45  
21 happens, right? You have many, many computers 03:50:46  
22 which compute a certain piece and then somebody 03:50:48  
23 has to go gather everything. But you still have 03:50:50  
24 to be able to identify which processor you want 03:50:53  
25 the data from, and that's what is considered the 03:50:55

1 node address or node ID. And if you send 03:50:58  
2 a packet, the packet is always sent from somebody 03:51:05  
3 to somebody and, since you expect an answer, the 03:51:07  
4 packet has to contain the sender ID, otherwise 03:51:10  
5 the return wouldn't possibly work. 03:51:13  
6 So in the TNet world, the source of 03:51:16  
7 destination address is necessary to identify the 03:51:21  
8 individual devices, the nodes, and the 4-byte 03:51:25  
9 TNet address is basically the -- sometimes it's 03:51:33  
10 called subaddress space identifying the devices 03:51:34  
11 inside a node. 03:51:38  
12 For example, in SCI case the semantic 03:51:39  
13 was chosen slightly different, one has said SCI 03:51:43  
14 has a 64-bit address space and the upper 16 bits 03:51:47  
15 by definition are the node ID and the rest 48 03:51:48  
16 bits are local addresses. Whether or not you 03:51:54  
17 separate that out and give them different fields, 03:51:57  
18 is really just a detail. 03:52:00  
19 Q. Right, isn't it possible, it says 03:52:03  
20 that on page 5, the TNet address is a 32-bit 03:52:05  
21 window into the destination's address space, 03:52:11  
22 right? 03:52:14  
23 A. Yes. 03:52:14  
24 Q. So for a PCI device, that would be 03:52:15  
25 the 32-bit address of the PCI device? 03:52:18

1	A. Not necessarily.	03:52:20
2	MR. DAVIS: Objection to form.	03:52:22
3	BY MR. BUROKER:	03:52:24
4	Q. But it could be. So that you	03:52:24
5	could use the A field to fill in the PCI device	03:52:26
6	address and use the header information to tell	03:52:30
7	you where on the network that PCI device is	03:52:33
8	found?	03:52:37
9	MR. DAVIS: Objection; form.	03:52:38
10	THE WITNESS: What you're referring to	03:52:44
11	is one particular example of the address	03:52:46
12	translation on the receiving node would be simple	03:52:53
13	which doesn't mean the address translation on the	03:52:56
14	sending node is trivial as well, because hardly	03:52:59
15	ever the particular address you try to reach on	03:53:04
16	the PCI subsegment would be available like that	03:53:06
17	on the host node. It might be that there is just	03:53:14
18	local memory, right? And you have to also take	03:53:16
19	into account you have many possible devices which	03:53:24
20	you want to connect to. For every of those	03:53:32
21	devices you have to have an address window in the	03:53:35
22	physical address space of the host CPU 1, 2 or 3.	03:53:38
23	They can't be all at the same place, right? So	03:53:40
24	already there you see that the address windows	03:53:44
25	you have to have in the host CPU initiating the	03:53:47

1 transactions cannot map directly to the potential 03:53:52  
2 address windows needed on the target device, the 03:53:57  
3 PCI is only one example. 03:54:00  
4 BY MR. BUROKER: 03:54:07  
5 Q. What do you think that it means 03:54:07  
6 when it says that the TNet address is a 32-bit 03:54:09  
7 window into the destination's address space? 03:54:12  
8 A. The destination address space 03:54:16  
9 could be more than 32 bits. 03:54:17  
10 Q. How do you get that from the word 03:54:25  
11 "window", meaning that it's just a portion of 03:54:26  
12 the ... 03:54:30  
13 A. This is a term of art, being used 03:54:31  
14 as that. So let's take this whole system as it 03:54:33  
15 would be built today, then this CPU has a 64-bit 03:54:38  
16 address space. And, let's say, I mean, the 03:54:44  
17 computers we have recently built have 256 03:54:49  
18 gigabytes of memory, so obviously there is no way 03:54:54  
19 in this context with this TNet to address all 256 03:54:56  
20 gigabytes. So in order for having 03:55:00  
21 a communication, one would have to restrict 03:55:07  
22 oneself to a 4-gigabyte sub-window in this huge 03:55:10  
23 address space which could be exposed to other 03:55:14  
24 nodes in TNet. But it may well be that every of 03:55:18  
25 these CPUs gets a different window based on the 03:55:22

1 address translation table in the TNet interface. 03:55:27

2 Q. So then this document also talks 03:55:36

3 about something called an "address validation and 03:55:38

4 translation table". 03:55:40

5 A. Yes. 03:55:42

6 Q. And that's described as being the 03:55:43

7 thing that would map the CPU's physical address 03:55:44

8 space to the virtual TNet address space, right? 03:55:47

9 A. Uh-huh. 03:55:51

10 Q. Okay. 03:55:52

11 A. Figure 7. Now, this thing has to 03:55:54

12 go both ways. And I mean, again, this is not 03:56:04

13 disclosed in here, but this is something I'm sure 03:56:09

14 Horst knows and also so do I, if you build 03:56:15

15 a system of that scale, this is what's being 03:56:18

16 called a shared memory system, right, or 03:56:22

17 a distributed memory system, allowing remote 03:56:27

18 direct access to the memory of other nodes inside 03:56:29

19 the system. When SCI was invented there was 03:56:33

20 a real war going on, very religious, as always, 03:56:38

21 between the distribute-shared-memory people and 03:56:43

22 the message-passing people. I mean these two 03:56:45

23 philosophies are maintained until today. So the 03:56:51

24 message-passing world says there is no 03:56:54

25 communication, direct communication to the local 03:56:58

1 memory of any other node, if you want to know 03:57:01  
2 something you send a message saying, "Please tell 03:57:03  
3 me what is stored there." And then the answer 03:57:05  
4 comes back, usually requiring the processor to 03:57:07  
5 actually actively respond. While the 03:57:09  
6 shared-memory functionality says, "I grab 03:57:12  
7 anything I just want." The caveat here is if you 03:57:14  
8 have an error in any node, imagine you build 03:57:18  
9 a system with a million processors -- I mean they 03:57:23  
10 exist in the Blue Gene -- and one processor 03:57:26  
11 starts writing funny nonsense to all sorts of 03:57:31  
12 addresses on the remote nodes. Now you have 03:57:34  
13 corrupted memory in another node and you have no 03:57:37  
14 way of finding who caused it because no debugger 03:57:40  
15 will possibly tell you that. That was the old 03:57:44  
16 argument from the message-passing people against 03:57:46  
17 the shared-memory people, saying, "You're 03:57:50  
18 building a system which cannot be debugged." And 03:57:53  
19 the shared-memory people said "Yeah, and your 03:57:55  
20 message-passing interface is so slow we're ten 03:57:57  
21 times faster." This is why there is more and 03:57:59  
22 more, and this is here also indicated, access 03:58:03  
23 protection built in, and this is why it's called 03:58:08  
24 address validation, so access validation, so the 03:58:11  
25 address translation tables in here basically 03:58:14

1 perform also the function of making sure that no 03:58:16  
2 unauthorized access to any other addresses inside 03:58:19  
3 the system is possible. 03:58:22

4 Q. So, let me just ask you some more 03:58:28  
5 questions about this flow we've been talking 03:58:30  
6 about. Is it your understanding that whatever 03:58:32  
7 packet that would be created by the CPU and 03:58:38  
8 passed through to the TNet processor interface, 03:58:41  
9 that then that information is transmitted on the 03:58:47  
10 physical layer, in other words over a cable, to 03:58:57  
11 the next hop in the system which I guess would be 03:59:01  
12 a router? 03:59:06

13 MR. DAVIS: Objection; form. 03:59:07

14 THE WITNESS: I have one problem with 03:59:12  
15 your question because you said whatever packet 03:59:14  
16 the CPU generated. The CPU does only memory 03:59:16  
17 transactions, the packets happen in the TNet 03:59:21  
18 processor interface. But aside from that ... 03:59:23

19 BY MR. BUROKER: 03:59:27

20 Q. So to be clear, some information 03:59:28  
21 is sent from the CPU and at the TNet processor 03:59:31  
22 a TNet packet is created and then it is placed on 03:59:36  
23 the physical layer for transmission to the router 03:59:43  
24 in Figure 9? 03:59:46

25 A. Yes. 03:59:47

1	Q. Okay.	03:59:48
2	A. And, I mean, one example of the	03:59:49
3	physical interface of TNet is Figure 4.	03:59:51
4	Q. Figure 4, right. And Figure 4	03:59:57
5	shows transmission over a cable that's used in	04:00:02
6	ECL?	04:00:10
7	A. Yeah.	04:00:11
8	Q. Right? ECL I guess it's called?	04:00:15
9	A. Yes.	04:00:17
10	Q. And do you agree with Mr. Young	04:00:21
11	that that is a form of low-voltage differential	04:00:24
12	signalling? Not the industry standard LVDS but	04:00:28
13	a form of low-voltage differential signalling?	04:00:33
14	A. The inventors of LVDS would now	04:00:43
15	yell and scream because LVDS was invented to do	04:00:45
16	away with ECL. ECL was the way signals were	04:00:52
17	communicated -- it's a differential standard, too	04:01:00
18	-- if things had to be fast. But ECL has been	04:01:03
19	extremely power hungry and usually is defined on	04:01:07
20	negative voltages which is the last thing you	04:01:12
21	really want in low-voltage ASICs these days.	04:01:16
22	It's a current signal, as it says,	04:01:20
23	emitter-coupled logic. The emitter drains	04:01:24
24	basically the current onto the cable. Voltages	04:01:27
25	only happen based on the termination scheme. I'm	04:01:29



1	not sure whether or not ECL is really	04:01:36
2	an established standard such as the IEEE 1596.3.	04:01:39
3	At 50,000 meters flight height one might say	04:01:48
4	there is certain similarities, but low-voltage	04:01:52
5	differential signalling, in particular the	04:01:56
6	original LVDS standard, was created to avoid ECL.	04:01:58
7	So I would not consider this in the broader	04:02:04
8	context. Now, if you say this is a differential	04:02:08
9	signal that is certainly correct.	04:02:13
10	Q. Right, and it is differential	04:02:16
11	signalling you agree with that?	04:02:20
12	A. Absolutely, yes.	04:02:21
13	Q. Okay. The question is whether	04:02:22
14	it's low voltage or not I guess is the issue,	04:02:26
15	right?	04:02:29
16	A. Yeah.	04:02:32
17	Q. And you say LVDS was a well-known	04:02:39
18	improvement over ECL for low-voltage differential	04:02:44
19	signalling?	04:02:48
20	A. LVDS is a big improvement over	04:02:49
21	ECL. As you can see ECL doesn't exist anymore.	04:02:53
22	I mean these computers all use LVDS, for	04:02:55
23	instance, to talk to the graphics display which	04:02:58
24	is by far the fastest, probably the fastest	04:03:00
25	connection inside laptop computers. I was	04:03:05

1 pointing to a laptop computer. ECL, for it being 04:03:09  
2 so very power hungry and for all the other 04:03:14  
3 disadvantages I just quoted, is, in this context, 04:03:17  
4 not being used. 04:03:20

5 Q. This figure shows the information 04:03:26  
6 the TNet packet going through an 8B/9B encoder. 04:03:31

7 A. Yeah. 04:03:38

8 Q. Do you agree that that is a form 04:03:39  
9 of encoding that meets the claim -- strike 04:03:41  
10 that -- that meets the term in the claim 24 of 04:03:46  
11 the '814 Patent? 04:03:49

12 A. It is one form of encoding and it 04:03:55  
13 does fit the definition of encoding which I set 04:03:57  
14 forth but it is not the particular incarnation of 04:04:00  
15 encoding which has been used in this patent. 04:04:03

16 Q. Right, but if something uses -- is 04:04:05  
17 it 8-bit/9-bit or 8-byte/9-byte? 04:04:09

18 A. Bit, 8-bit/9-bit encoder. 04:04:12

19 Q. Normally capital B mean byte. 04:04:13  
20 It's confusing. 04:04:17

21 So if somebody is using 8-bit/9-bit 04:04:18  
22 encoding then that would be the kind of encoding 04:04:22  
23 that is contemplated in claim 24 of the '814 04:04:26  
24 Patent, right? 04:04:31

25 A. If you would have said this is 04:04:41

1 a kind of encoding according to the definition I 04:04:43  
2 set forth, yes. 04:04:45

3 Q. Okay. 04:04:46

4 A. Now, I mean, to be honest, I mean, 04:04:47  
5 since I'm under oath and I'm trying to be really 04:04:51  
6 as accurate as I can possibly be, my 04:04:54  
7 understanding is these terms, as they are 04:04:56  
8 construed in the patent, have to be seen in the 04:04:58  
9 light of the patent document. This patent 04:05:01  
10 document doesn't discuss 8B/10B encoding or 8B/9B 04:05:05  
11 encoding or 4B/5B encoding, these are the typical 04:05:11  
12 standards. In fact 8B/9B is not very common. 04:05:16  
13 And since you specifically asked for claim 24 04:05:19  
14 this is now a detail of patent law I'm not 100 04:05:23  
15 percent sure how to answer. 04:05:27

16 Q. Okay. You agree though that 04:05:29  
17 what's shown in Figure 4 is a serial transmission 04:05:43  
18 of data between what says "Cabinet B" and 04:05:47  
19 "Cabinet A"? 04:05:51

20 MR. DAVIS: Objection to form. 04:05:52

21 THE WITNESS: If we go to the 04:05:56  
22 definition I put forth for what is serial -- and 04:05:58  
23 we looked at that already so I don't want to 04:06:01  
24 repeat it -- but it basically says if a certain 04:06:03  
25 amount of information is transmitted over 04:06:07

1 a smaller number of signals, then taking into 04:06:09  
2 account that processors at the time -- where this 04:06:13  
3 was published at the time when the patents were 04:06:17  
4 filed -- were typically 32 bits or more, then it 04:06:21  
5 is consistent to be a serial transmission, right? 04:06:27  
6 8 bits aren't much less than 32. 04:06:33  
7 BY MR. BUROKER: 04:07:05  
8 Q. So let me ask you then, the flow 04:07:05  
9 of data we've been talking about, looking at 04:07:17  
10 Figure 8, the TNet packet would come in and be 04:07:27  
11 received at the TNet interface and be stored in 04:07:35  
12 -- a packet buffer's just something to store 04:07:39  
13 things while other packets are being processed; 04:07:42  
14 is that right? 04:07:45  
15 MR. DAVIS: Objection; form. 04:07:46  
16 THE WITNESS: What really happens 04:07:53  
17 inside these packet buffers depends on a lot of 04:07:54  
18 things which are not disclosed in here. So, for 04:07:57  
19 example, if TNet would -- I don't remember the 04:08:01  
20 clock rate, whether there are any clock rates 04:08:09  
21 specified here, what is the transmission speed of 04:08:11  
22 TNet -- but if TNet would be much faster than the 04:08:13  
23 particular bus interface here, such as PCI, then 04:08:18  
24 it could happen that this interface cannot work 04:08:21  
25 off the packets at the speeds being arrived. 04:08:25

1                   Then there is typically what one                   04:08:28  
2           implements, so-called derandomizing buffers, to           04:08:32  
3           basically absorb a burst of writes. Of course           04:08:36  
4           that can only be done to a certain extent and in           04:08:40  
5           fact the size of such buffers has been always           04:08:43  
6           a long debate where lots of simulations are being           04:08:46  
7           done to find an optimum, because if you put in           04:08:49  
8           too much it just costs money and it's never being           04:08:51  
9           used and if you put in too little you introduce           04:08:54  
10          a lot of flow control on the network saying,           04:08:56  
11          "Wait, wait, wait, wait, can't do any more,           04:08:59  
12          slowing things down" and so forth.           04:09:01  
13                   The second reason for the packet           04:09:03  
14          buffers is once the packet is being received,           04:09:06  
15          there needs to be a decoding done, it needs to be           04:09:08  
16          understood what particular transaction should           04:09:11  
17          result from that, then the interface, once it           04:09:13  
18          recognized okay, "I need to do this transaction",           04:09:16  
19          it needs to acquire the PCI bus, so there has to           04:09:19  
20          go out a PCI bus request, a bus arbiter has to           04:09:23  
21          say, "You can" or, "You have to wait". When it           04:09:26  
22          says, "Bus granted, you can use the bus", it           04:09:28  
23          still has to wait for any possibly still ongoing           04:09:30  
24          bus transaction to finish. So these are random           04:09:33  
25          times causing delays, random delays. And only           04:09:36

1 after all of that has happened then the PCI 04:09:39  
2 transaction can happen, and then only the data 04:09:42  
3 which is starting to be accumulated here can be 04:09:45  
4 drained. 04:09:50  
5 So a rule of thumb is the minimum size 04:09:51  
6 of such a packet buffer would be the maximum 04:09:55  
7 packet size which could be received because 04:09:57  
8 otherwise you would risk losing data coming in 04:10:01  
9 and the buffer being full. 04:10:04  
10 BY MR. BUROKER: 04:10:04  
11 Q. So out of the buffer would be some 04:10:08  
12 information that would be depacketized. At what 04:10:12  
13 point in this were you contemplating that the PCI 04:10:15  
14 bus transaction would be generated? 04:10:19  
15 A. I mean that would have to happen 04:10:26  
16 in the bus interface, or I would put it into the 04:10:28  
17 context of the bus interface. 04:10:32  
18 Q. Yeah, but of these boxes in the 04:10:34  
19 bus interface, where would that take place? Oh, 04:10:35  
20 the one that just says "bus interface"? The long 04:10:39  
21 box that says "bus interface" -- 04:10:42  
22 A. Exactly. 04:10:45  
23 Q. -- within the square that says 04:10:46  
24 "TNet bus interface"? 04:10:47  
25 A. I mean, yeah. What you have here 04:10:48

1 is, again, there's just so many details which are 04:10:52  
2 implicit here but not obvious and not really 04:11:01  
3 shown. But if you look at the TNet link, this 04:11:03  
4 has got to be something running at relatively 04:11:07  
5 high clock rates. You have PCI on the other 04:11:10  
6 side, comparably slow clock rates. What comes in 04:11:14  
7 is byte write, right? I mean 9 bits but it's 04:11:20  
8 basically bytes in one or the other form, as 04:11:26  
9 outlined in the document here basically ... where 04:11:30  
10 is it? Yes, in fact, it's not explicitly in here 04:11:41  
11 at all. But obviously it can't be more than 9 04:11:52  
12 bits. In fact, no, it can only be 8 bits because 04:11:54  
13 it's an 8B/9B encoder and PCI is at least 04:11:58  
14 32 bits, so this whole thing has to be expanded, 04:12:02  
15 which is the functionality of the depacketizer. 04:12:06  
16 So you have a TNet interface with a rather high 04:12:10  
17 clock rate going into the packet buffers, and 04:12:13  
18 then the context depacketizer suggests that here 04:12:15  
19 the unframing is done, the word width is 04:12:20  
20 recreated. The packetizer would probably try to 04:12:23  
21 extract already the addresses and separate them 04:12:28  
22 from the data, create nice 32-bit data word 04:12:33  
23 chunks and so forth, and then the bus interface 04:12:37  
24 would have to know what to do with this kind of 04:12:40  
25 thing. And again Figure 8, of course, has to 04:12:42

1 have all the functionality in there that is also 04:12:46  
2 shown in Figure 7. So we, again, have address 04:12:48  
3 validation, translation, access control, the 04:12:51  
4 whole nine yards, which is not shown here at all. 04:12:56  
5 This is not something I would put as 04:12:59  
6 sub-functionality of the bus interface. In fact, 04:13:03  
7 I don't know where I would put this. I would say 04:13:06  
8 this is just missing here as abstracted away now. 04:13:07  
9 Q. But under that scenario, if a PCI 04:13:15  
10 bus transaction was created, it would be then 04:13:18  
11 sent on the PCI bus to be received by the PCI 04:13:25  
12 device to which it was addressed, right? 04:13:33  
13 A. Correct. 04:13:36  
14 MR. DAVIS: Objection to form. 04:13:37  
15 BY MR. BUROKER: 04:13:38  
16 Q. For that PCI device to act on the 04:13:38  
17 transaction, whatever the transaction is? 04:13:41  
18 A. (The witness nodded.) 04:13:43  
19 Q. Right? So, would you agree at 04:13:45  
20 a minimum that in that scenario the CPU has 04:13:49  
21 transmitted information that was used to create 04:13:55  
22 a PCI bus transaction? 04:14:01  
23 MR. DAVIS: Objection; form. 04:14:04  
24 THE WITNESS: Could you define 04:14:07  
25 "information that was used" a little bit more 04:14:15



1	specific?	04:14:17
2	BY MR. BUROKER:	04:14:17
3	Q. I'm trying to use in its broadest	04:14:18
4	sense, not trying to call it data, not trying to	04:14:21
5	call it address bits, just saying if the CPU sent	04:14:23
6	information that was received by and interpreted	04:14:26
7	by a PCI bus device?	04:14:36
8	MR. DAVIS: Objection; form.	04:14:39
9	THE WITNESS: The problem why I'm	04:14:43
10	hesitant to answer is there is some information	04:14:45
11	sent by the CPU which finally results in the PCI	04:14:49
12	transaction which, however, requires additional	04:14:53
13	other information which has to be set up earlier	04:14:55
14	in the context of everything, thereby the	04:14:58
15	information all by itself is not sufficient to	04:15:01
16	create such a PCI transaction. Therefore I'm not	04:15:04
17	sure whether I should say yes.	04:15:07
18	BY MR. BUROKER:	04:15:12
19	Q. And one of the reasons why you say	04:15:12
20	that Horst doesn't disclose everything in, for	04:15:13
21	example, claims 24 and 31, is that there is no	04:15:18
22	northbridge or peripheral bridge to communicate	04:15:23
23	all of the pieces of information of a PCI bus	04:15:28
24	transaction in serial form, right?	04:15:31
25	MR. DAVIS: Objection; form.	04:15:35

1	BY MR. BUROKER:	04:15:36
2	Q. That's one of the opinions you	04:15:37
3	offer. Like the header on page 85 of your '814	04:15:40
4	declaration.	04:15:47
5	MR. DAVIS: Objection; form.	04:15:56
6	THE WITNESS: I mean I do stand by what	04:15:58
7	I wrote in my report.	04:15:59
8	BY MR. BUROKER:	04:16:01
9	Q. And that's because no matter what	04:16:02
10	it's your view that what's transmitted over the	04:16:07
11	TNet network are TNet packets. That's the second	04:16:10
12	sentence of paragraph 129, right?	04:16:13
13	A. Yeah.	04:16:18
14	Q. And it's your view that the TNet	04:16:19
15	packets don't have all of the information to	04:16:23
16	compose a PCI transaction and, therefore, the	04:16:27
17	entire PCI bus transaction is not sent as part of	04:16:34
18	the TNet packet, right?	04:16:36
19	MR. DAVIS: Objection; form.	04:16:37
20	THE WITNESS: I mean in Horst, because	04:16:46
21	you say the entire PCI transaction is not sent	04:16:47
22	over the TNet, that would suggest that there is	04:16:50
23	a PCI bus here having PCI transactions. There is	04:16:52
24	no PCI transaction anywhere in this whole	04:16:57
25	architecture except for the far end inside the	04:17:00

1 controller. And I'm really happy to discuss this 04:17:03  
2 further but could have a short break now? 04:17:06  
3 MR. BUROKER: Sure, we'll go off the 04:17:11  
4 record. 04:17:13  
5 (Brief recess taken 4:17 p.m. - 4:27 p.m.) 04:17:13  
6 BY MR. BUROKER: 04:27:10  
7 Q. So let's talk about that same 04:27:14  
8 configuration we've been talking about, but where 04:27:20  
9 the PCI device wants to communicate with the CPU 04:27:22  
10 and, you know, all the caveats you had earlier 04:27:31  
11 about how it had to be configured and all that 04:27:35  
12 sort of stuff. But in that case the PCI device 04:27:38  
13 would originate a PCI transaction up the PCI bus, 04:27:41  
14 right? 04:27:45  
15 A. Of course, there is no other way. 04:27:46  
16 Q. And that would then get routed to 04:27:51  
17 the PCI bus interface that's shown in Figure 2 04:27:54  
18 and that we, you know, assume looks something 04:28:06  
19 like what's in Figure 8, right? 04:28:08  
20 A. Yes, but before we go further -- 04:28:14  
21 Q. Oh, I'm sorry, that's not right. 04:28:16  
22 So the PCI device would communicate and that 04:28:18  
23 would go to the PCI bus interface which would 04:28:20  
24 connect to a TNet bus interface or would it be 04:28:25  
25 a TNet PCI bus interface? I'm confused. 04:28:31

1 MR. DAVIS: Objection; form. 04:28:36

2 THE WITNESS: Yeah, I mean, according 04:28:37

3 what we discussed earlier I would say, if we look 04:28:39

4 at Figure 8, this is the PCI bus and that would 04:28:42

5 interface through this interface to TNet as 04:28:47

6 a system with everything. And what happens at 04:28:50

7 the far end then depends what target node is 04:28:53

8 being addressed. But before we go into details 04:28:56

9 I would like to know are we talking now read 04:28:59

10 transaction, write transaction, what transaction? 04:29:03

11 BY MR. BUROKER: 04:29:06

12 Q. I think I said, but let me 04:29:06

13 clarify, a write transaction. So the PCI wants 04:29:07

14 to write something into the memory associated 04:29:09

15 with one of the remote CPUs shown in Figure 9. 04:29:12

16 A. Uh-huh. 04:29:25

17 Q. Right? So it would start with 04:29:26

18 a PCI bus transaction of a write command type, it 04:29:28

19 would be transmitted on the PCI bus, right? 04:29:33

20 A. Yeah. 04:29:37

21 Q. That would end up at the PCI bus 04:29:38

22 interface which would then create a TNet packet, 04:29:42

23 correct? 04:29:48

24 A. No. 04:29:49

25 Q. What's wrong with what I said? 04:29:51

1                   A.    It would create one or multiple                   04:29:53  
2                   TNet packets because PCI bus transactions can               04:29:56  
3                   have a certain length and they can certainly have           04:29:59  
4                   more than 64 bytes being transmitted, that really       04:30:02  
5                   depends on what device you have. So, for                   04:30:06  
6                   example, in here you have disks connected, there           04:30:09  
7                   could be a PCI rate controller having a disk and           04:30:14  
8                   disk blocks are 512 bytes. But TNet, referring           04:30:17  
9                   to Figure 5, allows only zero to 64 bytes of               04:30:22  
10                  data. That means if there is a longer ongoing           04:30:28  
11                  PCI transaction that would result in multiple           04:30:32  
12                  TNet packets being generated, whatever size           04:30:34  
13                  packets then will depend on the detailed               04:30:39  
14                  configuration, but there is no one-to-one               04:30:42  
15                  relationship between a TNet packet and a bus           04:30:44  
16                  transaction, on either side be it a processor or       04:30:46  
17                  be it PCI.   04:30:49  
18                   Q.    Right, but the data would be the                   04:30:50  
19                   same. The data of a PCI bus transaction that is           04:30:51  
20                   of a write command would go directly into the           04:30:56  
21                   data field of a TNet packet, correct?               04:31:01  
22                   MR. DAVIS: Objection to form.                       04:31:07  
23                   THE WITNESS: It would be at the --                   04:31:10  
24                   THE COURT REPORTER: I didn't get the                   04:31:16  
25                   last word of the answer sorry, you were all three       04:31:16

1 speaking at the one time. You said, "It would be 04:31:16  
2 at the ..."? 04:31:19  
3 BY MR. BUROKER: 04:31:19  
4 Q. I'll just start over. 04:31:19  
5 So the data of a PCI transaction of 04:31:20  
6 a write command variety, would then be filled in 04:31:23  
7 to the data portion of a TNet packet, correct? 04:31:25  
8 MR. DAVIS: Objection; form. 04:31:33  
9 THE WITNESS: The data would go through 04:31:36  
10 the 8B/10B encoder as shown in Figure 4, but you 04:31:41  
11 can also nicely see the decoder to it to complete 04:31:47  
12 the symmetry. And on TNet there would be 04:31:50  
13 an encoded version of it. The data would be 04:31:52  
14 physically different but it could be recreated 04:31:56  
15 then by the 9B/8B decoder. 04:31:59  
16 BY MR. BUROKER: 04:32:03  
17 Q. And let's just say my write 04:32:04  
18 transaction I'm talking about a small amount of 04:32:06  
19 data, less than 64 bytes, then there would be one 04:32:08  
20 TNet packet that would need to be encoded to be 04:32:13  
21 transmitted over the TNet links, right? 04:32:19  
22 MR. DAVIS: Objection to form. 04:32:20  
23 THE WITNESS: I assume so. This is one 04:32:28  
24 way it could be done, yeah. The reason why I'm 04:32:34  
25 a bit careful here is the following. There are 04:32:38

1           often alignment requirements on data as to be put           04:32:44  
2           into packets. That means if you have a 32-byte           04:32:48  
3           write you want to do but it starts off at an odd           04:32:57  
4           address starting at address offset, say, 47,           04:33:02  
5           which means the 32 bytes align 32-byte blocks.           04:33:05  
6           It often happens that two network packets are           04:33:10  
7           being created for efficiency reasons. This           04:33:12  
8           really depends on lots of details how these           04:33:16  
9           interfaces are implemented. There is no clear           04:33:21  
10          indication in this document how it is being done,           04:33:26  
11          but this is something which happens a lot.           04:33:29  
12          BY MR. BUROKER:           04:33:29  
13                   Q. A simple form would be to take           04:33:31  
14                  just the data out of the PCI bus transaction and           04:33:33  
15                  fill it into the data component of the TNet           04:33:37  
16                  transaction and if there's any leftover space           04:33:43  
17                  just pad it with zeros, right? That's one way to           04:33:46  
18                  do it?           04:33:49  
19                   MR. DAVIS: Objection; form.           04:33:50  
20                   THE WITNESS: You can't pad with zeros,           04:33:54  
21                  because it would mean you write more data           04:33:57  
22                  which --           04:33:59  
23          BY MR. BUROKER:           04:33:59  
24                   Q. Well, it's --           04:34:00  
25                   A. And you don't have to, because the           04:34:01

1	TNet packet has a length word which allows it to	04:34:07
2	be of variable length. But the padding is being	04:34:11
3	done in case of other networks which have	04:34:15
4	fixed-length packets where basically zeros are	04:34:17
5	being padded but then there is still an indicator	04:34:21
6	which of the bytes are actually valid.	04:34:25
7	Q. Forget what I said. A simple form	04:34:29
8	of transmission of the data would be to just take	04:34:32
9	the data from the PCI bus transaction, fill it	04:34:35
10	into the data field and then set the data link to	04:34:38
11	indicate the exact length of that data from the	04:34:45
12	bus transaction?	04:34:48
13	MR. DAVIS: Objection to form.	04:34:49
14	THE WITNESS: And this is one possible	04:34:50
15	way it can be done, yet it's not disclosed here	04:34:56
16	in particular.	04:34:59
17	BY MR. BUROKER:	04:35:02
18	Q. And what is why your view about	04:35:05
19	what would happen to the other pieces of the PCI	04:35:07
20	bus transaction as part of the process to create	04:35:10
21	the TNet packet?	04:35:19
22	MR. DAVIS: Objection; form.	04:35:22
23	THE WITNESS: What do you mean with the	04:35:23
24	other portions?	04:35:24
25	BY MR. BUROKER:	04:35:27



1                   Q.    So the address, the command, the                   04:35:27  
2                   control line and the byte enables, the other               04:35:29  
3                   things. You know there's 47 bits that we talked           04:35:32  
4                   about on the PCI bus transaction, what happens to           04:35:36  
5                   the rest of those bits of data?                           04:35:38  
6                   MR. DAVIS: Objection; form.                           04:35:42  
7                   THE WITNESS: I would expect the TNet                   04:35:47  
8                   interface not to respond to all -- or not to               04:35:50  
9                   transform all the particular PCI commands into           04:35:56  
10                  TNet functionalities. So, for example, I                   04:36:01  
11                  wouldn't say any way to, for instance, do a PCI           04:36:06  
12                  configuration cycle for TNet, right?                       04:36:10  
13                  What we are doing here is we're jumping                   04:36:14  
14                  forth and back between a higher abstraction layer           04:36:16  
15                  and more transaction and physical layer inside           04:36:21  
16                  these buses and that can cause confusion,               04:36:24  
17                  therefore I would like to be really careful.               04:36:26  
18                  There is the class of read                               04:36:30  
19                  transactions, there is the class of write                   04:36:32  
20                  transactions and there is a whole subclass of               04:36:34  
21                  read transactions which is in PCI defined as               04:36:36  
22                  a read configuration, read I/O, read memory. In           04:36:39  
23                  case of a processor you have yet another set of           04:36:46  
24                  kinds of reads, the entire span of cache                   04:36:50  
25                  coherency protocols which are all flavors of               04:36:56

1 reads. TNet just can do a read, nothing else. 04:36:58  
2 So all the other functionality behind is gone 04:37:05  
3 inside TNet and has to be, if needed, recreated 04:37:11  
4 by some auxiliary infrastructure we already 04:37:14  
5 discussed. 04:37:18  
6 So, in this case, I would expect the 04:37:19  
7 interface between PCI and TNet to be configured 04:37:22  
8 after everything is initialized to basically 04:37:25  
9 respond to memory reads and memory writes. That 04:37:28  
10 would be the easiest thing, and that would be the 04:37:31  
11 context in which I expect this document to be 04:37:35  
12 written namely having an I/O device, being PCI, 04:37:39  
13 which has produced some data, which it wants to 04:37:46  
14 deliver to some CPU, and in this context we don't 04:37:49  
15 need to understand the difference between a read, 04:37:53  
16 a read multiple, or a write line or whatever, we 04:37:55  
17 don't need to understand cache coherency, we just 04:37:57  
18 need that data to find its way all the way 04:38:00  
19 through the system to the far end, to the memory, 04:38:02  
20 right? But there is no one-to-one correlation 04:38:05  
21 between any given PCI transaction and any given 04:38:11  
22 TNet packet. 04:38:13  
23 And, I mean, I understand this is it 04:38:17  
24 important and I think it becomes really, really 04:38:18  
25 clear if you take a read transaction, because 04:38:23

1 writes can be posted, reads cannot. 04:38:27

2 BY MR. BUROKER: 04:38:27

3 Q. But to continue what we were 04:38:31

4 talking about, a write PCI bus transaction is 04:38:33

5 sent and the TNet interface, the TNet-PCI 04:38:43

6 interface creates one or more TNet packet that 04:38:49

7 gets sent over the same set of components, the 04:38:54

8 routers and so forth, and they end up at the 04:38:59

9 processor interface associated with the correct 04:39:03

10 CPU, correct? 04:39:08

11 A. Provided all the translation 04:39:09

12 tables, everything is initialized properly, yeah. 04:39:11

13 Q. Okay. And so then that processor 04:39:14

14 interface, the TNet processor interface, would 04:39:17

15 then pass the TNet packet, it would create 04:39:20

16 whatever form of bus transaction the CPU was 04:39:31

17 expecting, right? 04:39:34

18 MR. DAVIS: Objection to form. 04:39:37

19 BY MR. BUROKER: 04:39:40

20 Q. Looking at Figure 7 in that 04:39:40

21 line between the TNet processor facing the RISC 04:39:42

22 CPU, for example, there would be some interface 04:39:47

23 that would create perhaps a CPU bus transaction, 04:39:50

24 right? 04:39:54

25 A. This figure, to me, isn't 04:39:56

1 perfectly clear. If I take this figure and one 04:39:59  
2 has to be really careful with these very high 04:40:04  
3 level figures, but if I take this figure and take 04:40:07  
4 it literally, we could say if there is a write 04:40:09  
5 transaction arriving at the TNet link there is 04:40:12  
6 absolutely no need to bother the CPU on the 04:40:15  
7 system bus, because that ASIC here -- sorry, this 04:40:19  
8 TNet processor interface, which I assume to be 04:40:22  
9 an ASIC because it has to be quite fast, has 04:40:24  
10 a direct memory interface, even part of this 04:40:26  
11 design block, so it could perform the write 04:40:30  
12 transaction directly to the memory without 04:40:32  
13 bothering the CPU. So, in an extreme case, there 04:40:35  
14 could be a write transaction coming in, being 04:40:39  
15 executed against the memory by the CPU, execute 04:40:41  
16 another transaction against TNet to some other 04:40:43  
17 address sending a network packet out, because 04:40:46  
18 network is able to submit and receive 04:40:50  
19 simultaneously. 04:40:52  
20 However -- and this is the reason why 04:40:53  
21 I'm puzzled, this is bad style -- because that 04:40:55  
22 means the snooping functionality of that RISC 04:40:58  
23 CPU -- 04:40:58  
24 Q. The what kind of functionality? 04:41:05  
25 A. Snooping, like Snoopy. 04:41:07

1	Q. Okay, that's what I thought you	04:41:08
2	said but I wanted to make sure.	04:41:09
3	A. This is a term of art, believe it	04:41:11
4	or not, and it really comes from Snoopy being	04:41:13
5	very nosy.	04:41:16
6	Q. So the snooping functionality.	04:41:24
7	A. It means the following. These	04:41:27
8	CPUs, and I've shown you all of them have caches,	04:41:30
9	and if you have data in a cache and somebody else	04:41:33
10	writes to memory, it can happen that the data	04:41:40
11	written to is the data of which you have a cached	04:41:44
12	copy. Yeah?	04:41:48
13	Q. Right.	04:41:50
14	A. If that happens, aside from the	04:41:50
15	CPU without the CPU knowing, you have what we	04:41:53
16	call a stale copy. And if you have a system	04:41:55
17	which allows you to have a stale copy of a cache,	04:42:00
18	you have created a computer which is not working,	04:42:02
19	or you have to do a whole lot in software on top	04:42:08
20	of that. The only remedy to this problem would	04:42:12
21	be that every time you try to read something from	04:42:15
22	an area where you suspect somebody could have	04:42:18
23	possibly written, meaning you have an enabled	04:42:22
24	remote access to that region, you have to flush	04:42:24
25	the caches. Now, flushing caches is something	04:42:27

1 extremely expensive you really don't want to do. 04:42:30  
2 So this is why processors have a functionality, 04:42:33  
3 they basically watch what is happening on the 04:42:36  
4 bus. Like somebody else comes in, writes to the 04:42:38  
5 memory, the processor says, "Wait a minute I want 04:42:41  
6 to see what you're doing here." Then it compares 04:42:43  
7 the physical addresses on that bus, and if then 04:42:45  
8 there is a match to a cache line being hit, 04:42:47  
9 either the cache line is being invalidated as safe 04:42:50  
10 or, even fancier, the processor -- sorry the 04:42:54  
11 cache does that, looks what is the data being 04:42:59  
12 transmitted and copies it simultaneously while it 04:43:01  
13 goes from memory into the cache line and then you 04:43:03  
14 still have a coherent cache line, yeah? And 04:43:05  
15 caches were well known at that time and were very 04:43:13  
16 important already. So this figure here certainly 04:43:16  
17 leaves something out or doesn't mention something 04:43:18  
18 which would be quite useful to have. 04:43:20  
19 Q. Well at a minimum the CPU would be 04:43:22  
20 connected to the main memory through something 04:43:24  
21 other than the TNet processor interface, right? 04:43:27  
22 MR. DAVIS: Objection; form. 04:43:30  
23 THE WITNESS: I mean the way it's drawn 04:43:32  
24 here has some deficiencies. 04:43:34  
25 BY MR. BUROKER:

1                   Q.    But in like Figure 2 it shows them  
2   like connected --

3                   A.    Yeah, but this is so abstract in a  
4   way --

5                   Q.    -- or drawn together, right?

6                   A.    But in Figure 2 the memory talks                   04:43:46  
7   directly to the TNet and this is obviously not                   04:43:48  
8   happening.                   04:43:51

9                   Q.    Okay, so in that situation,                   04:44:00  
10   somehow or another the TNet processor link has                   04:44:04  
11   taken the packet created a transaction to write                   04:44:09  
12   the data that came from our PCI bus device into                   04:44:15  
13   memory.                   04:44:21

14                  A.    Uh-huh.                   04:44:22

15                  Q.    Right?                   04:44:23

16                  MR. DAVIS:  Objection; form.                   04:44:23

17   BY MR. BUROKER:                   04:44:27

18                  Q.    So is it fair to say that the CPU                   04:44:28  
19   main memory components received PCI bus                   04:44:33  
20   transaction information or not?                   04:44:40

21                  MR. DAVIS:  Objection; form.                   04:44:42

22                  THE WITNESS:  They received the payload                   04:44:43  
23   of a PCI write, they did not receive a PCI                   04:44:47  
24   transaction, it's not there anymore, it's                   04:44:54  
25   something else.                   04:44:59

1 BY MR. BUROKER: 04:44:59

2 Q. And when would you say the PCI bus 04:45:00

3 transaction in that flow ceased to exist? 04:45:03

4 A. Exactly at the moment where it 04:45:08

5 leaves the PCI to TNet interface. In the very 04:45:10

6 moment where the packetizing starts to happen, we 04:45:15

7 have something else. For it to continue to exist 04:45:18

8 one would have to be able to show that all the 04:45:24

9 states and functionality defined in here would 04:45:27

10 have to still be present. 04:45:30

11 Q. And that's based on your 04:45:32

12 understanding of the TNet -- strike that -- of 04:45:33

13 the term "PCI bus transaction". Would you agree 04:45:35

14 if a broader interpretation of PCI bus 04:45:40

15 transaction was adopted by the PTAB here, which 04:45:43

16 just required some of the information from a PCI 04:45:51

17 bus transaction, that in that definition the CPU 04:45:53

18 memory elements have received at least a portion 04:46:02

19 of the PCI bus transaction, the payload? 04:46:04

20 MR. DAVIS: Objection; form. 04:46:07

21 THE WITNESS: I'm not aware of such a 04:46:09

22 definition. 04:46:10

23 BY MR. BUROKER: 04:46:12

24 Q. I'm just saying -- and this is 04:46:12

25 a hypothetical -- if they were to adopt it, would 04:46:14



1           you agree that at least you said the payload           04:46:19  
2           would be received; is that correct?           04:46:20  
3                   MR. DAVIS:  Objection; form.           04:46:22  
4                   THE WITNESS:  These what-if discussions           04:46:26  
5           are dangerous because they are highly           04:46:29  
6           hypothetical.  In that case I would like to           04:46:31  
7           review the exact wording of the adopted           04:46:33  
8           definition, then I would like to take my time and           04:46:35  
9           really verify this against the patent claims and           04:46:39  
10          the entire prior art cited in order to give           04:46:42  
11          a competent answer.  But upon some very generic I           04:46:46  
12          think this is quite difficult.  And, second,           04:46:49  
13          I would have a problem because you cannot talk           04:46:52  
14          about a standard and then say we just take part           04:46:54  
15          of it because then it's not a standard anymore.           04:46:56  
16          I mean, this is the fundamental principle of the           04:46:58  
17          definition of such a thing.  You have to have the           04:47:05  
18          complete functionality or it won't work.           04:47:08  
19          BY MR. BUROKER:           04:47:08  
20                   Q.  Right, well, but claim 24 never           04:47:14  
21          identifies a PCI device that has to use that           04:47:19  
22          information, right?           04:47:23  
23                   MR. DAVIS:  Objection to form.           04:47:27  
24                   THE WITNESS:  There is no PCI device           04:47:41  
25          explicitly mentioned in claim 24, yet --           04:47:43

1	BY MR. BUROKER:	04:47:45
2	Q. Of the '814 Patent?	04:47:46
3	A. Of the 814 Patent, correct.	04:47:48
4	Q. Right.	04:47:50
5	A. Yet a PCI transaction is executed	04:47:50
6	in order to communicate with the PCI device,	04:47:54
7	nothing else makes any sense. So this is	04:47:57
8	implicitly clearly stated here. It's implicitly	04:47:59
9	included so I should say.	04:48:05
10	Q. But it's not explicitly included?	04:48:05
11	A. Sorry, I misspoke. I am sorry,	04:48:12
12	it's implicitly included.	04:48:14
13	Q. But based on what? Just because	04:48:16
14	it uses the word "PCI bus transaction" you're	04:48:18
15	saying implicitly it requires that there be a PCI	04:48:22
16	bus device to be able to receive and process it?	04:48:26
17	MR. DAVIS: Objection; form.	04:48:27
18	THE WITNESS: For what other reason	04:48:29
19	would you execute a PCI transaction?	04:48:30
20	BY MR. BUROKER:	04:48:31
21	Q. Well, it doesn't say you execute	04:48:31
22	a PCI transaction.	04:48:33
23	MR. DAVIS: Objection; form.	04:48:34
24	BY MR. BUROKER:	04:48:36
25	Q. Does it?	04:48:36

1                   A.   "... the north bridge to                   04:48:43  
2                   communicate address and data bits of a PCI               04:48:43  
3                   transaction in serial form ..."  
4                   -- going on further and further.   What               04:48:50  
5                   would the purpose be to communicate a PCI               04:48:52  
6                   transaction somewhere unless one wanted to               04:48:58  
7                   execute such PCI transaction?                   04:49:00  
8                   Q.    I don't know.   It's one of the --               04:49:01  
9                   the claim doesn't say that you have to execute           04:49:03  
10                  a PCI bus transaction, correct?                   04:49:05  
11                  MR. DAVIS:   Objection; form.                   04:49:10  
12                  BY MR. BUROKER:                               04:49:12  
13                  Q.    Claim 24 of the '814 Patent.               04:49:12  
14                  A.    Well, if you read the patent it's               04:49:15  
15                  quite obvious it's stated in here.               04:49:17  
16                  Q.    Right, but your job and the PTAB's           04:49:20  
17                  job is to compare what's in the claim to the           04:49:23  
18                  prior art.   So claim 24 doesn't explicitly say       04:49:27  
19                  that a PCI bus transaction has to be executed,       04:49:29  
20                  correct?                               04:49:33  
21                  MR. DAVIS:   Objection; form.                   04:49:36  
22                  THE WITNESS:   I mean I believe I               04:49:47  
23                  already answered.   I believe it is implicitly       04:49:48  
24                  included, but it's not explicitly stated, yes.       04:49:50  
25                  BY MR. BUROKER:                               04:49:50

1                   Q.    So is that part of the                   04:49:56  
2                   interpretation of claim 24 that you used in                   04:49:57  
3                   looking at the prior art?  You were looking to                   04:49:58  
4                   make sure that the prior art actually executed                   04:50:00  
5                   PCI bus transactions that are communicated from                   04:50:03  
6                   the northbridge?                   04:50:07  
7                   MR. DAVIS:  Objection; form.                   04:50:09  
8                   THE WITNESS:  No, I mean I have                   04:50:13  
9                   outlined how I looked at these claims, and the                   04:50:15  
10                  discussion we conduct is whether or not there is                   04:50:18  
11                  an encoded -- I mean one of the areas we're                   04:50:22  
12                  discussing here, aside from the other                   04:50:25  
13                  functionality such as address translation and                   04:50:28  
14                  coding, were whether or not there were encoded                   04:50:32  
15                  PCI transactions on the discussed network, which                   04:50:34  
16                  are in the two references SCI and TNet.                   04:50:37  
17                  BY MR. BUROKER:                   04:50:37  
18                  Q.    Right.  And then is your opinion                   04:50:43  
19                  also the same that having a PCI bus transaction                   04:50:45  
20                  that can be executed is implicitly required by                   04:50:51  
21                  claim 31 of the '814 Patent and claim 54 of the                   04:50:54  
22                  '873 Patent?                   04:51:03  
23                  MR. DAVIS:  Objection; form.                   04:51:06  
24                  THE WITNESS:  I mean in the context of                   04:51:20  
25                  PCI transaction it clearly says:                   04:51:21

1                   "... a peripheral bridge coupled to                   04:51:23  
2                   said microprocessor unit without any intervening                   04:51:25  
3                   Peripheral Component Interconnect (PCI) bus, said                   04:51:27  
4                   peripheral bridge coupled to second LVDS channel                   04:51:31  
5                   to communicate address and data bits of PCI bus                   04:51:34  
6                   transaction in serial form over said second ...                   04:51:34  
7                   channel."                   04:51:34  
8                   And this is what I used to evaluate.                   04:51:38  
9                   BY MR. BUROKER:                   04:51:44  
10                   Q.     But if the peripheral bridge in                   04:51:45  
11                   chamber 31 transmits the PCI bus transaction that                   04:51:50  
12                   never gets received and never gets executed as                   04:51:55  
13                   a result, is it your understanding that the claim                   04:51:59  
14                   has been met or not met?                   04:52:02  
15                   A.     It strict sense it has been met,                   04:52:05  
16                   but it wouldn't make any sense to build a system                   04:52:07  
17                   like that. And you would be hard pressed to find                   04:52:09  
18                   one.                   04:52:13  
19                   Q.     Well, you'd find one where the PCI                   04:52:15  
20                   device was broken and didn't receive the                   04:52:17  
21                   transaction, it would still have been sent,                   04:52:21  
22                   right?                   04:52:23  
23                   MR. DAVIS: Objection; form.                   04:52:25  
24                   BY MR. BUROKER:                   04:52:28  
25                   Q.     So there are circumstances in                   04:52:28

1           which a device may send a PCI bus transaction to           04:52:29  
2           a device and nothing happens because that device       04:52:32  
3           is broken.           04:52:35

4                   A.    Yeah, but this would be a highly           04:52:40  
5           constructed special case and the system was still       04:52:43  
6           built to communicate between this host and the       04:52:46  
7           PCI device and, in such an exceptional case,       04:52:49  
8           a transaction would fail but it would still be       04:52:54  
9           legitimate transaction on the bus, it would time       04:52:56  
10          out, and be responded to as an error.       04:52:58

11                  Q.    So is it fair to say that one of           04:53:05  
12          the reasons why you believe that the term "PCI       04:53:07  
13          bus transaction" requires the entirety of the PCI       04:53:10  
14          specification is because otherwise execution of       04:53:15  
15          the claim doesn't make any sense?       04:53:24

16                  MR. DAVIS:   Objection; form.           04:53:26

17                  THE WITNESS:   The claim says "PCI bus       04:53:31  
18          transaction", PCI is a well-defined standard, so       04:53:33  
19          this is basically just already stated right here.       04:53:35  
20          That it wouldn't make any sense above and beyond       04:53:39  
21          is a different story, but I believe it is       04:53:42  
22          sufficient that it says here "PCI bus       04:53:43  
23          transaction" and, I mean, we have discussed       04:53:46  
24          before that under the broadest reasonable       04:53:48  
25          interpretation, this is how it would have to be       04:53:50

1	interpreted.	04:53:54
2	BY MR. BUROKER:	04:53:54
3	Q. In your view for the Horst	04:54:03
4	reference, would any of the address information	04:54:04
5	in that PCI bus transaction that was originated	04:54:09
6	by our PCI device be conveyed to the memory CPU?	04:54:13
7	A. You mean that some bits of the	04:54:20
8	original PCI transaction ended up being the same	04:54:22
9	at the far end? Is that the message? I'm not	04:54:26
10	sure I understand.	04:54:29
11	Q. Right, yeah.	04:54:30
12	A. Well, you have to --	04:54:31
13	Q. Not randomly the same. Let me ask	04:54:33
14	it differently.	04:54:36
15	So the scenario we talked about where	04:54:39
16	you've got a PCI bus transaction that's started	04:54:41
17	by a PCI device and sent up through the pipe	04:54:42
18	towards the CPU and memory, that scenario.	04:54:45
19	A. Uh-huh.	04:54:48
20	Q. Would any of the information from	04:54:49
21	the PCI bus transaction that was created, the	04:54:51
22	address information, find its way up through the	04:54:56
23	TNet system to the CPU/memory?	04:55:00
24	MR. DAVIS: Objection; form.	04:55:04
25	THE WITNESS: To answer that question	04:55:08

1 I would have to have a definition of the address 04:55:09  
2 translation in this document -- and I'm pointing 04:55:13  
3 to the Horst reference -- is actually being done, 04:55:15  
4 this is not disclosed at all. There is no 04:55:18  
5 indication, as far as I know, unless you point me 04:55:21  
6 to it and I overlooked it, which says how it 04:55:25  
7 works in particular. It is typically done as 04:55:29  
8 a table lookup, but typically done doesn't mean 04:55:32  
9 it is done like this here or it is obviously to 04:55:35  
10 do it like that. 04:55:37  
11 BY MR. BUROKER: 04:55:41  
12 Q. And what do you mean by "a table 04:55:41  
13 lookup", what would that mean? Would the address 04:55:43  
14 information in the PCI bus transaction be 04:55:45  
15 included in the TNet -- 04:55:51  
16 A. No. 04:55:53  
17 Q. -- packet? 04:55:55  
18 A. As far as I know, there is no 04:56:01  
19 address translation which is done or even 04:56:06  
20 possible which is functioning through some sort 04:56:09  
21 of an algorithm, right, you calculate the 04:56:12  
22 translated address. There is many reasons for 04:56:18  
23 it. It is always done like that. You have 04:56:21  
24 a particular address which you like to translate 04:56:25  
25 and then there is a bunch of tables which can 04:56:28



1	have a rather complex form, they can be	04:56:30
2	hierarchical, where the translated address is	04:56:36
3	being searched. Now, what is the granularity of	04:56:40
4	those tables or how the particular searching	04:56:43
5	algorithm works depends on the particular	04:56:46
6	implementation and there is nothing disclosed in	04:56:51
7	Horst, and I therefore don't wish to speculate,	04:56:53
8	but in my declaration I put an example of	04:56:56
9	an address translation which is in the book by	04:56:59
10	Dave Patterson and Hennessey, right? There is	04:57:04
11	a diagram which shows one way it's being done as	04:57:09
12	an example.	04:57:12

13 Q. Do you know where that is in your 04:57:13

14 declaration? 04:57:15

15                   A.    I'm already looking.  I got the                   04:57:16

16                   wrong here, here is '873.  Page 20, for example.           04:57:18

17 Q. Which declaration? 04:57:41

18 A. '814. 04:57:42

19 Q. Okay. 04:57:52

20	A. Before we go into details, one	04:57:53
21	again has to be very clear that an address is	04:57:56
22	only valid if you have all bits. Like	04:57:58
23	a telephone number, if I take off two or three	04:58:00
24	bits of telephone number, the rest of the bits	04:58:03
25	have no meaning, or you need to dial a lot of	04:58:04

1 numbers before you reach the right number. 04:58:08

2 The way it is usually being done in 04:58:12

3 computers, sorry, in processors -- so you are far 04:58:14

4 outside the TNet context now -- but in case of 04:58:20

5 a microprocessor there are the address 04:58:23

6 translation where the main memory is broken up 04:58:29

7 into so-called pages. The size of a page is 04:58:32

8 a fixed thing and depends really on the 04:58:35

9 architecture of the processor, and that has some 04:58:38

10 reasons which are quite complicated and have to 04:58:41

11 do with the fact that one tries to make the 04:58:46

12 address translation as efficient as possible, 04:58:48

13 allowing it to happen in parallel to the cache 04:58:50

14 lookup. Typical page sizes are 4 kilobytes. And 04:58:54

15 that means for every virtual address, the upper 04:58:59

16 bits beyond the 4 kilobytes are basically that 04:59:02

17 page number being addressed, right? You could 04:59:08

18 say page number 0, 1, 2, 3, 4, 5 until you 04:59:12

19 reached the full space. This is what he calls 04:59:15

20 the virtual page number. That goes into 04:59:19

21 a translation scheme. Extremely oversimplifying 04:59:21

22 you could say this is a table which basically has 04:59:26

23 as index this virtual page number and as content 04:59:31

24 the physical page number to which it translates 04:59:35

25 to. In reality it's not done like that, that 04:59:38

1	simple, because then these tables would become	04:59:42
2	huge, consuming --	04:59:45
3	Q. You're looking at page ...	04:59:50
4	A. Page 20.	04:59:52
5	Q. Page 20 of the '814?	04:59:53
6	A. '814. Ah wait ... yeah '814.	04:59:55
7	There you are but how come it's on the left page	05:00:14
8	in your case?	05:00:15
9	Q. This is the '873 declaration.	05:00:17
10	A. Oh, I can also use the '873	05:00:21
11	declaration, it doesn't matter. Just let me find	05:00:24
12	it here.	05:00:27
13	Q. Oh, I know why, I'm looking at	05:00:30
14	page 20 of the response, it's my fault. It's	05:00:32
15	been a long day.	05:00:36
16	Page 20, we're on the same page, 20 of	05:00:37
17	the '814. Okay, I see where you're talking	05:00:41
18	about.	05:00:44
19	A. So typically this translation	05:00:45
20	scheme are multiple references to main memory of	05:00:46
21	the computer trying to find the right page	05:00:50
22	number, but for the simplicity of the argument	05:00:54
23	you could consider this as a one-step process	05:00:58
24	being a large, large single vector. That means	05:01:00
25	the physical address is assembled by the	05:01:04

1 translated physical page number and the lower 12 05:01:09  
2 address bits which are the same as the virtual 05:01:14  
3 address. This is how a microprocessor does it. 05:01:17  
4 This is how basically every processor does it 05:01:20  
5 with implementation variance on the translation 05:01:23  
6 table itself. And for every process in the 05:01:27  
7 system you have an individual private address 05:01:29  
8 translation table, meaning for every virtual 05:01:32  
9 address scope you have such a table. 05:01:37  
10 Q. Okay, but going back in 05:01:41  
11 paragraph 135 of the '814 declaration, you say 05:01:42  
12 because: 05:01:48  
13 "... TNet address are virtual addresses 05:01:48  
14 ... that TNet address cannot be PCI standard 05:01:52  
15 addresses which are physical addresses." 05:01:57  
16 A. Yeah. 05:01:59  
17 Q. But couldn't you just fill in the 05:02:04  
18 PCI bus address field into the A field of your 05:02:13  
19 TNet packet? 05:02:17  
20 MR. DAVIS: Objection -- 05:02:20  
21 BY MR. BUROKER: 05:02:21  
22 Q. 32 bits for 32 bits, you couldn't 05:02:22  
23 do that? 05:02:24  
24 MR. DAVIS: Objection; form. 05:02:24  
25 THE WITNESS: What would it help you? 05:02:26

1 I mean I tried to outline that in a TNet system 05:02:31  
2 like that, you have so many different address 05:02:38  
3 spaces and every node has its own predefined 05:02:41  
4 local physical address space already, right? So, 05:02:45  
5 you can't just use any arbitrary PCI address to 05:02:51  
6 address something inside this target node because 05:02:57  
7 they wouldn't match. That doesn't rule out that 05:03:02  
8 under some extreme rare conditions in one 05:03:06  
9 particular case there would be a trivial 05:03:10  
10 translation, but the general case is certainly 05:03:13  
11 not correct. 05:03:15  
12 BY MR. BUROKER: 05:03:16  
13 Q. Well what about in a situation 05:03:17  
14 where instead of having multiple CPU memories, 05:03:18  
15 like you see in Figure 9, you just had one? So 05:03:22  
16 all of the devices on the PCI bus could use an 05:03:33  
17 addressing scheme that would map to the memory, 05:03:43  
18 the single CPU memory? 05:03:48  
19 MR. DAVIS: Objection; form. 05:03:50  
20 BY MR. BUROKER: 05:03:54  
21 Q. So that you could then use the PCI 05:03:54  
22 bus address straight into the TNet address field? 05:03:56  
23 MR. DAVIS: Objection; form. 05:04:03  
24 BY MR. BUROKER: 05:04:05  
25 Q. Is that possible is my question. 05:04:05

1 MR. DAVIS: Objection; form. 05:04:07

2 THE WITNESS: I mean you're trying to 05:04:11

3 re-engineer TNet back to a PCI hierarchical 05:04:14

4 single-node system. I would have to consider 05:04:19

5 that. It's not disclosed at all or even 05:04:24

6 suggested in this disclosure here. It wouldn't 05:04:27

7 make much sense to use the system as such. 05:04:31

8 BY MR. BUROKER: 05:04:39

9 Q. But your testimony is that what 05:04:39

10 would make sense would be to throw away the 05:04:41

11 address piece of a PCI bus transaction and create 05:04:44

12 a new one. Is that right? 05:04:48

13 A. To map -- 05:04:50

14 MR. DAVIS: Objection; form. 05:04:50

15 THE WITNESS: -- you have to lay out 05:04:52

16 an address scheme for all of the devices 05:04:55

17 involved. In order to implement that you have 05:04:58

18 your address translation. Whether or not in 05:05:00

19 a particular case the translation could be 05:05:08

20 trivial, I don't know it's possible, but it's 05:05:11

21 certainly not the general case and it's certainly 05:05:19

22 not indicated in here, and it would make it 05:05:21

23 unlikely that this system works with a large 05:05:29

24 number of nodes. And still you wouldn't have 05:05:32

25 a PCI transaction in the far end because then 05:05:39

1 there is just an ordinary CPU. 05:05:41

2 BY MR. BUROKER: 05:05:51

3 Q. Right, but in that scenario, if 05:05:52

4 you took the address information and the data 05:05:53

5 information out of the PCI bus transaction and 05:05:58

6 you communicated both of those through TNet 05:06:00

7 packets up to the CPU/memory, you would have 05:06:03

8 communicated at least the address and data 05:06:09

9 information of a PCI bus transaction to 05:06:13

10 a northbridge, right? 05:06:16

11 MR. DAVIS: Objection; form. 05:06:17

12 THE WITNESS: In order to know whether 05:06:28

13 or not that could possibly work we would have to 05:06:30

14 really study the details of a particular 05:06:32

15 processor, the already predefined address maps 05:06:35

16 inside that system, same for the PCI subsystem. 05:06:39

17 And if that all would work out and one could 05:06:45

18 create such an address map, which would be more 05:06:48

19 like a lucky windfall and only work for a rather 05:06:51

20 -- like you constructed a single-node system in 05:06:56

21 my mind -- then you would transmit the 05:06:59

22 information of the PCI transaction. You would 05:07:05

23 still not transmit the PCI transaction, the 05:07:08

24 payload. 05:07:11

25 BY MR. BUROKER: 05:07:14

1 Q. Did you know Dr. Horst? 05:07:14

2 A. No. 05:07:16

3 Q. Have you ever seen this TNet 05:07:17

4 article on the IEEE? 05:07:21

5 A. I did not. 05:07:23

6 Q. Did you receive IEEE publications? 05:07:25

7 A. We have them in the library, in 05:07:33

8 fact I have purchased them, grinding my teeth 05:07:38

9 because it's really expensive. But there is 05:07:41

10 a lot of material. I certainly didn't read all 05:07:45

11 IEEE papers, there's no way I could do that. 05:07:48

12 Q. Sure. And had you ever heard of 05:07:51

13 the TNet system? 05:07:52

14 A. No. 05:07:53

15 Q. And you knew who Tandy -- Tandy or 05:07:54

16 Tandem? 05:07:57

17 A. Tandem. 05:07:57

18 Q. Tandem Computer Company was, 05:07:59

19 right? 05:08:01

20 A. (The witness nodded.) 05:08:01

21 Q. Had you ever done any work with 05:08:02

22 Tandem Computer Company before -- well, had you 05:08:04

23 ever done work with Tandem Computer Labs? 05:08:06

24 A. Not that I'm aware of. In fact, I 05:08:10

25 mean for me TNet would have not been something 05:08:15



1 highly exciting because the reasoning for 05:08:19  
2 developing it is not something I follow to 05:08:26  
3 100 percent because, for example, they argue that 05:08:36  
4 SCI is useless to them because of all the added 05:08:38  
5 complexity of the cache coherency protocols, 05:08:42  
6 neglecting the detail that there is 05:08:45  
7 a non-coherent version of SCI which is exactly 05:08:47  
8 what I have been using, so to me there would have 05:08:51  
9 been no benefit switching technologies. Then 05:08:53  
10 TNet would have been something proprietary by 05:08:55  
11 Tandem. Highly unclear whether or not these 05:08:58  
12 network devices would be sold openly on the 05:09:03  
13 market, which is a strict requirement for us 05:09:06  
14 being able to use this technology. It would be 05:09:10  
15 a sole source. Sole sources are a big problem if 05:09:12  
16 you build these large-scale systems with a plan 05:09:16  
17 15 or 20 years in the future. This is why we 05:09:21  
18 really like standards in this context, therefore, 05:09:24  
19 that was likely for me not to show up on my radar 05:09:28  
20 screen. And if somebody in my contacts would 05:09:31  
21 have seen it, it would most likely not have been 05:09:34  
22 something where somebody would have said, "Hey, 05:09:39  
23 you really have to read this." 05:09:41  
24 MR. BUROKER: I'm about to move to 05:09:49  
25 a different subject, why don't we take a break 05:09:50

1	and go off the record.	05:09:50
2		05:09:50
3	(Volume I of II in the deposition of Volker	05:09:52
4	Lindenstruth concluded at 5:09 p.m.)	
5		
6	- - - - -	
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

ACKNOWLEDGEMENT OF DEPONENT

I, VOLKER LINDENSTRUTH, do hereby certify that I have read the foregoing transcript of my testimony taken on 8/27/15, and further certify that it is a true and accurate record of my testimony (with the exception of the correction listed below):

Page	Line	Correction
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

\_\_\_\_\_  
VOLKER LINDENSTRUTH

SUBSCRIBED AND SWORN TO BEFORE ME

THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 20\_\_\_\_.

1 REPORTER'S CERTIFICATION

2 UNITED KINGDOM:

3 I, Audrey Shirley, accredited court  
4 reporter, do hereby certify that the witness whose  
5 deposition is hereinbefore set forth appeared  
6 before me in London, United Kingdom on the 27th  
7 day of August 2015, at 8:57 a.m.; was duly sworn  
8 before the commencement of the deposition; that  
9 the testimony was taken down by me using machine  
10 shorthand; that all appearances of counsel and  
11 participants hereto are noted on the appearance  
12 page; and that such deposition is a true,  
13 correct, and full record of the proceedings.

14 I further certify that I am not related  
15 to nor employed by any of the parties to this  
16 action; that I am not employed by counsel for any  
17 of the parties to this action; and that I am in  
18 no way interested in the outcome of this matter.

19 IN WITNESS WHEREOF, I have hereunto set  
20 my hand this 27th day of August 2015.

21  
22  
23   
24

25 AUDREY SHIRLEY, Court Reporter

	1		2	
<p>'1462 [1] - 115:18</p> <p>'1469 [3] - 85:21, 115:17, 157:22</p> <p>'814 [63] - 5:25, 28:10, 28:12, 29:7, 37:8, 37:15, 57:24, 59:23, 76:11, 107:13, 109:20, 109:21, 110:8, 112:2, 115:16, 116:2, 146:22, 148:7, 151:5, 151:23, 152:3, 159:7, 159:11, 162:6, 162:11, 163:12, 163:25, 169:20, 170:3, 173:7, 173:9, 173:24, 179:17, 180:2, 180:25, 183:20, 184:1, 184:11, 186:16, 187:17, 188:16, 188:20, 191:11, 191:17, 191:24, 192:14, 192:18, 192:21, 194:25, 195:19, 233:12, 233:24, 241:4, 257:3, 258:14, 259:22, 264:19, 266:6, 266:7, 266:18, 267:12</p> <p>'873 [22] - 5:20, 6:3, 23:17, 115:17, 127:7, 140:9, 146:21, 161:22, 162:11, 168:15, 173:7, 179:22, 179:24, 183:22, 184:7, 186:17, 187:3, 192:21, 259:23, 264:17, 266:10, 266:11</p> <p>'93 [2] - 34:18, 35:20</p> <p>'96 [5] - 68:19, 84:25, 97:2, 106:7, 204:10</p> <p>'98 [2] - 68:19, 106:7</p> <p>'99/2000 [1] - 125:10</p> <p>'bus [1] - 153:6</p> <p>'Peripheral [1] - 113:3</p> <p>'submitted [1] - 60:12</p>	<p>1 [9] - 2:8, 2:17, 4:24, 5:5, 129:2, 224:10, 224:11, 226:23, 265:19</p> <p>1) [1] - 158:21</p> <p>1,000 [1] - 73:22</p> <p>1,100 [1] - 73:19</p> <p>1-4 [1] - 160:1</p> <p>1.2 [1] - 183:4</p> <p>1.5 [1] - 183:6</p> <p>10 [3] - 16:8, 153:8, 172:6</p> <p>10,000 [2] - 90:17, 214:12</p> <p>100 [5] - 15:5, 46:14, 144:15, 234:15, 272:4</p> <p>1000 [1] - 99:11</p> <p>1001 [2] - 115:16, 115:18</p> <p>1009 [2] - 173:6, 173:8</p> <p>1011 [8] - 37:6, 51:7, 58:1, 75:13, 87:16, 89:1, 103:21, 173:7</p> <p>1027 [4] - 3:10, 99:7, 99:12, 99:13</p> <p>1050 [1] - 2:5</p> <p>10:20 [1] - 57:20</p> <p>10:27 [1] - 57:20</p> <p>11 [2] - 86:13, 87:4</p> <p>1100 [1] - 135:14</p> <p>111 [1] - 15:6</p> <p>113 [1] - 112:8</p> <p>114 [8] - 15:6, 111:25, 113:12, 125:1, 125:2, 125:19, 133:16, 146:1</p> <p>116 [2] - 155:22, 155:24</p> <p>11:44 [1] - 111:23</p> <p>11:51 [1] - 111:23</p> <p>12 [2] - 87:14, 267:2</p> <p>120 [1] - 155:23</p> <p>129 [1] - 241:13</p> <p>12:00 [1] - 111:19</p> <p>12:39 [1] - 141:13</p> <p>13 [14] - 28:20, 29:3, 151:16, 151:19, 151:21, 152:2, 152:6, 152:23, 153:5, 158:5, 179:12, 179:19, 179:24</p> <p>133 [2] - 194:23, 195:1</p> <p>135 [1] - 267:12</p> <p>1394 [11] - 180:20, 181:17, 181:21, 181:23, 182:10,</p>	<p>182:14, 183:24, 184:15, 184:25, 185:4, 185:18</p> <p>13A [1] - 179:20</p> <p>14 [14] - 28:25, 29:3, 151:16, 151:17, 151:19, 151:21, 152:2, 152:5, 152:23, 153:6, 179:12, 179:19, 179:24</p> <p>1462 [1] - 14:2</p> <p>1469 [2] - 14:1, 37:7</p> <p>15 [9] - 28:9, 28:13, 29:3, 49:11, 179:12, 184:7, 192:22, 272:18</p> <p>150 [1] - 49:15</p> <p>1596.3 [5] - 182:17, 182:23, 183:3, 183:7, 232:3</p> <p>16 [10] - 35:8, 130:6, 130:7, 133:7, 133:19, 133:21, 219:13, 223:25, 225:15</p> <p>16-bit [1] - 157:13</p> <p>17 [10] - 35:6, 151:16, 151:19, 151:21, 152:1, 152:2, 179:19, 180:2, 180:5, 180:6</p> <p>170 [3] - 37:15, 57:22, 76:11</p> <p>171 [1] - 60:8</p> <p>174 [3] - 78:14, 82:1, 87:11</p> <p>176 [2] - 78:18, 79:1</p> <p>18 [1] - 103:16</p> <p>19 [6] - 50:5, 50:8, 62:21, 64:3, 64:7, 107:9</p> <p>1962 [1] - 4:18</p> <p>1980 [2] - 35:9, 43:22</p> <p>1993 [3] - 24:15, 24:16, 25:14</p> <p>1996 [17] - 56:16, 59:18, 60:12, 65:7, 67:20, 75:12, 76:4, 77:14, 81:15, 83:3, 86:12, 89:14, 97:17, 102:15, 102:22, 105:25</p> <p>1996-1998 [1] - 55:10</p> <p>1997 [1] - 86:4</p> <p>1998 [8] - 24:12, 25:12, 32:6, 32:20, 52:21, 102:19, 106:1, 110:9</p> <p>1:26 [1] - 141:13</p>	<p>2 [27] - 56:16, 59:18, 60:12, 62:24, 87:25, 129:2, 158:17, 158:21, 181:1, 195:10, 196:12, 199:10, 199:15, 200:22, 201:15, 213:16, 215:10, 216:11, 221:2, 223:19, 224:10, 224:20, 226:23, 242:18, 254:2, 254:7, 265:19</p> <p>2-1 [3] - 144:15, 144:20, 144:21</p> <p>2.1 [7] - 49:18, 49:20, 124:12, 124:25, 125:12, 125:17, 126:7</p> <p>2.2 [2] - 125:9, 125:12</p> <p>20 [17] - 16:8, 17:25, 21:23, 40:23, 47:6, 55:6, 78:9, 78:10, 97:15, 107:13, 264:17, 266:5, 266:6, 266:15, 266:17, 272:18</p> <p>20-bit [1] - 223:9</p> <p>2001 [3] - 124:14, 124:15, 125:21</p> <p>20036-5306 [1] - 2:6</p> <p>2005 [1] - 43:25</p> <p>2007/8/9 [1] - 43:24</p> <p>2012 [1] - 22:5</p> <p>2014 [2] - 77:2, 77:14</p> <p>2014-01469 [1] - 5:15</p> <p>2015 [5] - 1:15, 35:8, 77:3, 275:7, 275:20</p> <p>202 [1] - 2:8</p> <p>2021 [3] - 13:24, 14:1</p> <p>2024 [1] - 157:22</p> <p>2026 [1] - 85:21</p> <p>20 [1] - 274:23</p> <p>21 [2] - 130:5, 192:16</p> <p>22 [6] - 180:25, 181:2, 181:10, 184:2, 184:11, 192:16</p> <p>23 [1] - 144:23</p> <p>24 [32] - 43:15, 116:2, 118:7, 136:16, 139:14, 146:18, 146:22, 154:23, 159:6, 159:10, 161:12, 161:17, 163:12, 163:18, 163:25, 166:12, 166:22, 173:23, 174:21, 187:16,</p>	<p>188:3, 188:15, 197:4, 233:11, 233:24, 234:14, 240:22, 256:21, 257:1, 258:14, 258:19, 259:3</p> <p>24th [1] - 43:15</p> <p>25 [2] - 43:19, 44:7</p> <p>250 [1] - 15:3</p> <p>256 [2] - 227:18, 227:20</p> <p>26 [2] - 184:2, 184:11</p> <p>26th [1] - 86:4</p> <p>27 [1] - 1:15</p> <p>27th [2] - 275:6, 275:20</p> <p>28 [1] - 148:10</p> <p>29 [1] - 86:12</p> <p>29th [1] - 89:13</p> <p>2:41 [1] - 186:5</p> <p>2:51 [1] - 186:5</p> <p>2nd [1] - 87:22</p>
				3
				<p>3 [9] - 18:9, 88:1, 192:19, 224:11, 224:12, 224:14, 224:19, 226:23, 265:19</p> <p>3,000 [1] - 90:19</p> <p>3-1 [1] - 128:7</p> <p>3-2 [1] - 131:7</p> <p>3.1 [2] - 42:2, 42:14</p> <p>3.2 [2] - 42:4, 42:14</p> <p>3.3 [1] - 43:6</p> <p>3.3.1 [1] - 142:12</p> <p>30 [7] - 72:6, 110:9, 125:14, 125:20, 125:23, 184:2, 184:11</p> <p>31 [11] - 140:3, 160:19, 161:4, 162:6, 162:11, 162:14, 166:9, 188:20, 240:22, 259:22, 260:12</p> <p>32 [16] - 125:22, 125:23, 125:24, 126:24, 127:7, 127:19, 224:2, 224:9, 224:15, 227:10, 235:5, 235:7, 238:15, 246:6, 267:23</p> <p>32-bit [9] - 134:12, 135:25, 184:15, 184:25, 197:21, 225:21, 226:1, 227:7, 238:23</p>
0				
<p>0 [1] - 265:19</p> <p>011 [1] - 86:16</p> <p>01462 [2] - 6:4, 23:17</p> <p>ODZ [1] - 1:21</p>				

<b>32-byte</b> [2] - 246:3, 246:6 <b>33</b> [1] - 159:25 <b>33rd</b> [1] - 56:7 <b>36</b> [6] - 35:8, 35:9, 128:3, 142:6, 142:8, 142:10 <b>37</b> [6] - 128:4, 144:11, 144:14, 145:9, 145:10, 145:17 <b>372</b> [1] - 135:8 <b>380</b> [1] - 2:13  <b>4</b>  <b>4</b> [16] - 3:4, 18:9, 49:13, 88:5, 135:24, 181:11, 187:3, 192:19, 231:4, 231:5, 234:18, 245:11, 265:15, 265:17, 265:19 <b>4-bit</b> [1] - 130:6 <b>4-byte</b> [3] - 222:16, 222:19, 225:9 <b>4-gigabyte</b> [1] - 227:23 <b>40,000</b> [1] - 72:6 <b>41</b> [1] - 157:1 <b>4126</b> [1] - 2:17 <b>46</b> [1] - 88:19 <b>47</b> [5] - 145:10, 145:12, 150:13, 246:5, 248:4 <b>48</b> [1] - 225:16 <b>49</b> [4] - 87:14, 145:12, 153:3, 184:10 <b>4:17</b> [1] - 242:6 <b>4:27</b> [1] - 242:6 <b>4B/5B</b> [1] - 234:12  <b>5</b>  <b>5</b> [8] - 18:9, 152:13, 192:19, 222:9, 225:21, 244:10, 265:19 <b>50</b> [3] - 1:20, 16:7, 187:3 <b>50,000</b> [1] - 232:4 <b>50/50</b> [1] - 16:14 <b>500</b> [1] - 84:11 <b>512</b> [1] - 244:9 <b>52</b> [2] - 35:7, 142:11 <b>54</b> [7] - 140:8, 161:22, 161:25, 162:11, 162:15, 168:15, 259:22 <b>55-bit</b> [1] - 150:16 <b>55128</b> [1] - 5:10	<b>566</b> [1] - 2:17 <b>58</b> [1] - 187:3 <b>5:09</b> [1] - 273:5 <b>5A</b> [1] - 192:19  <b>6</b>  <b>6</b> [5] - 44:16, 86:17, 102:14, 192:19, 202:6 <b>60</b> [1] - 16:7 <b>64</b> [4] - 222:18, 244:5, 244:10, 245:20 <b>64-bit</b> [5] - 134:12, 135:22, 135:23, 225:15, 227:16 <b>65,000</b> [2] - 80:13, 157:14 <b>65,535</b> [1] - 80:13 <b>68040</b> [2] - 197:22, 198:16  <b>7</b>  <b>7</b> [28] - 144:16, 144:23, 145:10, 152:20, 180:25, 192:16, 192:19, 197:7, 200:4, 200:9, 200:19, 202:12, 203:9, 204:12, 204:23, 206:1, 206:9, 206:10, 207:6, 207:11, 209:7, 210:12, 210:13, 211:22, 212:3, 228:12, 239:3, 250:21 <b>720</b> [1] - 2:17 <b>75</b> [1] - 49:15 <b>77</b> [1] - 113:23  <b>8</b>  <b>8</b> [29] - 62:21, 107:13, 143:23, 143:24, 180:25, 192:19, 197:15, 197:17, 197:20, 198:7, 199:14, 199:17, 199:22, 200:4, 200:10, 200:18, 202:13, 203:8, 204:12, 204:25, 205:5, 206:18, 235:7, 235:11, 238:13, 239:1, 242:20, 243:5 <b>8,041,873</b> [2] - 1:12, 5:20	<b>8-bit</b> [1] - 35:10 <b>8-bit/9-bit</b> [3] - 233:18, 233:19, 233:22 <b>8-byte/9-byte</b> [1] - 233:18 <b>8/27/15</b> [1] - 274:4 <b>80</b> [9] - 80:5, 80:15, 80:17, 90:21, 151:4, 151:6, 151:24, 151:25, 179:23 <b>80021-8023</b> [1] - 2:15 <b>8080</b> [2] - 79:24, 80:11 <b>8080/RD24/rd24.html</b> [1] - 102:17 <b>81</b> [2] - 183:20, 184:10 <b>814</b> [1] - 257:4 <b>82</b> [1] - 186:7 <b>84</b> [1] - 5:10 <b>85</b> [1] - 241:4 <b>8541</b> [1] - 2:8 <b>8:57</b> [2] - 1:22, 275:7 <b>8B/10B</b> [2] - 234:11, 245:11 <b>8B/9B</b> [4] - 233:7, 234:11, 234:13, 238:14 <b>8th</b> [1] - 4:18  <b>9</b>  <b>9</b> [12] - 201:14, 201:24, 204:21, 205:2, 205:9, 206:2, 217:22, 230:25, 238:8, 238:12, 243:16, 268:16 <b>900</b> [1] - 2:14 <b>91</b> [3] - 169:19, 170:8, 170:9 <b>93</b> [1] - 15:5 <b>955</b> [1] - 2:8 <b>96-33"</b> [1] - 56:4 <b>96-33</b> [1] - 102:15 <b>97</b> [2] - 188:9, 191:7 <b>98</b> [1] - 188:9 <b>98-030</b> [1] - 100:15 <b>99</b> [1] - 3:10 <b>9B/8B</b> [1] - 245:16  <b>A</b>  <b>a.m</b> [6] - 1:22, 57:20, 111:23, 275:7 <b>A4</b> [1] - 84:17 <b>abbreviation</b> [1] - 159:2 <b>abbreviations</b> [2] - 158:14, 158:25 <b>ABCD</b> [1] - 190:11 <b>ability</b> [1] - 8:4	<b>able</b> [22] - 49:5, 71:18, 76:24, 83:18, 85:17, 88:12, 129:22, 133:5, 133:9, 133:20, 134:3, 169:17, 190:13, 201:10, 204:10, 204:17, 224:25, 251:19, 255:9, 257:17, 272:15 <b>absolutely</b> [14] - 10:16, 14:18, 65:8, 72:11, 74:15, 134:19, 158:13, 169:13, 186:15, 202:2, 219:10, 219:21, 232:13, 251:7 <b>absorb</b> [2] - 26:9, 236:4 <b>abstract</b> [4] - 10:22, 34:3, 223:20, 254:4 <b>abstracted</b> [1] - 239:9 <b>abstraction</b> [4] - 196:1, 196:25, 216:10, 248:15 <b>academic</b> [2] - 29:25, 30:1 <b>accelerator</b> [5] - 44:21, 54:1, 73:15, 100:19, 100:20 <b>accelerators</b> [1] - 101:6 <b>accent</b> [1] - 166:6 <b>accents</b> [1] - 157:9 <b>accept</b> [1] - 69:21 <b>acceptance</b> [1] - 70:1 <b>accepted</b> [1] - 70:14 <b>accepting</b> [1] - 70:2 <b>access</b> [15] - 63:15, 63:16, 65:6, 68:23, 80:4, 97:17, 98:1, 98:18, 131:17, 228:19, 229:23, 229:25, 230:3, 239:4, 252:25 <b>access"</b> [1] - 64:2 <b>accessed</b> [1] - 64:24 <b>accessible</b> [8] - 21:16, 62:23, 63:13, 63:19, 64:4, 64:9, 64:11, 77:4 <b>accident</b> [1] - 177:15 <b>accompany</b> [1] - 53:15 <b>according</b> [10] - 8:15, 72:25, 118:1, 124:4, 180:16, 183:7, 207:13, 222:15, 234:2, 243:3	<b>account</b> [5] - 93:8, 178:21, 213:12, 226:20, 235:3 <b>accounts</b> [2] - 93:6, 93:8 <b>accredited</b> [1] - 275:3 <b>accumulated</b> [1] - 237:4 <b>accurate</b> [4] - 17:14, 86:19, 234:7, 274:5 <b>accurately</b> [1] - 154:8 <b>accused</b> [1] - 9:9 <b>acknowledge</b> [1] - 134:23 <b>ACKNOWLEDGEMENT</b> [1] - 274:1 <b>ACM</b> [11] - 118:15, 118:20, 119:15, 119:17, 119:25, 186:21, 195:16, 195:17, 195:22, 196:9, 197:6 <b>ACQIS</b> [1] - 1:8 <b>Acqis</b> [18] - 11:20, 12:3, 12:14, 13:10, 13:24, 18:24, 19:13, 22:16, 22:17, 108:10, 108:11, 108:16, 108:20, 108:24, 108:25, 109:9, 157:22, 193:8 <b>Acqis's</b> [2] - 15:13, 109:12 <b>Acqis-Alcatel-Lucent</b> [1] - 12:14 <b>acquire</b> [1] - 236:20 <b>acquired</b> [2] - 43:7, 72:9 <b>Acquisition</b> [2] - 3:11, 103:19 <b>acquisition</b> [2] - 41:25, 106:9 <b>ACR</b> [1] - 1:22 <b>acronym</b> [2] - 56:14, 67:25 <b>act</b> [1] - 239:17 <b>action</b> [2] - 275:16, 275:17 <b>actively</b> [1] - 229:6 <b>actual</b> [3] - 147:22, 158:5, 180:10 <b>AD</b> [1] - 129:6 <b>adapter</b> [5] - 41:17, 42:25, 47:20, 212:11, 219:16 <b>adapters</b> [2] - 42:20, 47:16 <b>add</b> [4] - 49:19, 150:7, 150:14, 155:14 <b>add-on</b> [1] - 49:19
--	--	---	---	---

<p><b>added</b> [2] - 153:6, 272:5</p> <p><b>adding</b> [1] - 151:9</p> <p><b>addition</b> [2] - 145:3, 188:16</p> <p><b>address</b> [19] - 18:12, 31:3, 33:7, 34:5, 113:11, 121:16, 131:20, 142:24, 150:14, 150:24, 159:16, 186:18, 189:1, 189:20, 190:20, 194:4, 194:5, 216:17, 240:13</p> <p><b>address</b> [206] - 4:20, 5:3, 5:8, 91:5, 91:14, 91:16, 92:9, 92:10, 92:12, 93:13, 107:4, 113:15, 113:16, 113:25, 114:2, 114:3, 114:17, 114:22, 114:23, 116:14, 116:20, 117:1, 119:7, 119:25, 121:6, 121:11, 122:19, 123:2, 123:10, 126:8, 126:9, 126:10, 126:23, 126:24, 127:13, 127:14, 129:5, 129:7, 129:9, 129:13, 130:9, 131:7, 132:11, 132:12, 133:9, 133:17, 134:10, 135:19, 135:22, 135:24, 135:25, 137:3, 137:4, 137:5, 137:19, 138:9, 138:13, 138:21, 139:8, 140:5, 141:7, 142:23, 143:19, 145:6, 146:3, 146:24, 148:1, 154:15, 164:16, 165:11, 165:16, 167:25, 169:4, 171:15, 174:9, 174:12, 174:15, 174:18, 174:20, 175:20, 175:21, 175:25, 176:6, 176:19, 176:24, 177:10, 177:15, 177:16, 177:24, 178:10, 178:13, 179:3, 179:6, 190:16, 191:2,</p>	<p>196:14, 207:20, 207:21, 207:22, 207:25, 208:3, 208:9, 209:15, 209:17, 209:22, 210:3, 210:4, 210:10, 210:11, 210:23, 211:12, 211:18, 212:2, 219:19, 219:21, 219:22, 219:24, 220:2, 221:12, 222:17, 223:9, 224:2, 224:5, 224:6, 224:8, 224:12, 224:13, 224:14, 224:16, 224:18, 224:19, 225:2, 225:8, 225:10, 225:15, 225:21, 225:22, 226:1, 226:7, 226:12, 226:14, 226:16, 226:22, 226:23, 226:25, 227:3, 227:7, 227:8, 227:9, 227:17, 227:20, 227:24, 228:2, 228:4, 228:8, 228:9, 229:25, 230:1, 239:3, 240:6, 246:5, 248:2, 251:18, 258:3, 259:14, 260:6, 262:5, 262:23, 263:2, 263:14, 263:20, 263:23, 263:25, 264:3, 264:10, 264:22, 265:6, 265:13, 265:16, 267:1, 267:3, 267:4, 267:8, 267:10, 267:14, 267:15, 267:19, 268:3, 268:5, 268:6, 268:7, 268:23, 269:12, 269:17, 269:19, 270:5, 270:9, 270:16, 270:19</p> <p><b>address</b> [1] - 129:6</p> <p><b>addressed</b> [7] - 92:4, 115:3, 131:17, 172:2, 239:13, 243:9, 265:18</p> <p><b>addresses</b> [24] - 4:21, 80:15, 136:1, 138:2, 174:2, 174:4, 174:8, 174:14, 185:4, 209:21, 211:14, 211:23, 211:25, 212:1, 215:21,</p>	<p>225:17, 229:13, 230:3, 238:22, 253:8, 267:14, 267:16</p> <p><b>addressing</b> [18] - 134:12, 135:23, 145:13, 172:19, 172:20, 173:11, 173:12, 173:13, 173:17, 173:25, 175:16, 175:22, 176:17, 178:2, 184:16, 184:25, 222:10, 268:18</p> <p><b>Adobe</b> [3] - 82:23, 83:4, 83:22</p> <p><b>adopt</b> [1] - 256:1</p> <p><b>adopted</b> [2] - 255:16, 256:8</p> <p><b>advanced</b> [1] - 160:11</p> <p><b>advantage</b> [1] - 186:20</p> <p><b>advantages</b> [1] - 186:9</p> <p><b>affidavit</b> [3] - 85:22, 86:17, 89:24</p> <p><b>affiliated</b> [3] - 46:15, 96:14, 100:3</p> <p><b>affiliations</b> [1] - 73:23</p> <p><b>age</b> [5] - 34:22, 35:5, 35:7, 35:8, 94:25</p> <p><b>agencies</b> [1] - 70:19</p> <p><b>agent</b> [1] - 209:20</p> <p><b>ago</b> [11] - 11:22, 21:23, 35:8, 40:23, 41:16, 47:6, 51:11, 51:17, 78:9, 78:10, 79:14</p> <p><b>AGP</b> [1] - 160:12</p> <p><b>agree</b> [23] - 20:10, 51:23, 65:13, 74:4, 77:2, 87:17, 117:6, 121:7, 122:20, 174:21, 191:11, 194:13, 198:23, 204:21, 205:7, 218:15, 231:11, 232:12, 233:9, 234:17, 239:20, 255:14, 256:2</p> <p><b>agreement</b> [2] - 19:5, 105:10</p> <p><b>agreements</b> [3] - 76:6, 76:16, 76:19</p> <p><b>ahead</b> [3] - 125:15, 208:21, 221:4</p> <p><b>Alcatel</b> [3] - 12:13, 12:14, 12:25</p> <p><b>Alcatel-Lucent</b> [2] - 12:13, 12:25</p>	<p><b>algorithm</b> [3] - 178:11, 263:22, 264:6</p> <p><b>algorithms</b> [1] - 213:9</p> <p><b>ALICE</b> [14] - 55:5, 55:14, 73:18, 73:23, 74:1, 74:6, 74:8, 74:12, 93:3, 100:23, 101:13, 101:14, 101:23</p> <p><b>align</b> [1] - 246:6</p> <p><b>alignment</b> [1] - 246:2</p> <p><b>allow</b> [5] - 71:13, 175:22, 202:23, 203:3, 212:15</p> <p><b>allowed</b> [1] - 120:16</p> <p><b>allowing</b> [5] - 31:18, 171:8, 201:17, 228:18, 265:14</p> <p><b>allows</b> [5] - 31:16, 215:13, 244:10, 247:2, 252:18</p> <p><b>almost</b> [7] - 21:22, 40:22, 47:11, 69:25, 78:9, 111:19, 215:15</p> <p><b>alone</b> [5] - 88:12, 123:20, 190:18, 208:13, 224:6</p> <p><b>altogether</b> [2] - 15:3, 16:7</p> <p><b>ambiguity</b> [1] - 157:4</p> <p><b>ambiguous</b> [1] - 159:2</p> <p><b>America</b> [1] - 157:7</p> <p><b>amount</b> [11] - 18:2, 23:10, 26:8, 45:22, 46:5, 54:22, 61:19, 137:23, 178:8, 235:1, 245:19</p> <p><b>analysis</b> [13] - 22:13, 23:8, 27:18, 36:3, 108:8, 108:15, 136:25, 137:17, 139:3, 140:20, 162:10, 171:19, 172:5</p> <p><b>analyze</b> [1] - 26:10</p> <p><b>analyzed</b> [2] - 25:5</p> <p><b>analyzing</b> [4] - 36:18, 73:17, 115:11, 163:22</p> <p><b>AND</b> [3] - 1:1, 1:2, 274:22</p> <p><b>Andreas</b> [2] - 39:23, 97:22</p> <p><b>announce</b> [1] - 4:5</p> <p><b>answer</b> [36] - 7:21, 7:22, 12:25, 17:15, 25:10, 32:12, 33:11, 34:4, 34:20, 34:24, 35:1, 62:4, 63:25, 72:19, 75:6, 78:1,</p>	<p>78:3, 92:1, 104:24, 106:14, 108:1, 129:21, 146:9, 155:6, 158:12, 164:7, 193:11, 219:2, 223:14, 225:4, 229:4, 234:16, 240:11, 245:1, 256:12, 263:1</p> <p><b>answered</b> [1] - 258:24</p> <p><b>answering</b> [5] - 26:18, 125:16, 150:21, 165:18, 178:17</p> <p><b>answers</b> [3] - 7:19, 75:7, 155:7</p> <p><b>anticipated</b> [1] - 36:19</p> <p><b>anticipation</b> [1] - 172:9</p> <p><b>anyway</b> [6] - 19:24, 72:5, 124:21, 126:5, 158:24, 193:24</p> <p><b>apart</b> [1] - 50:13</p> <p><b>apologies</b> [1] - 128:16</p> <p><b>apologize</b> [8] - 7:21, 52:5, 71:3, 71:6, 141:25, 155:10, 184:21, 192:21</p> <p><b>APPEAL</b> [1] - 1:2</p> <p><b>Appeals</b> [1] - 108:25</p> <p><b>appear</b> [1] - 23:25</p> <p><b>appearance</b> [1] - 275:11</p> <p><b>appearances</b> [1] - 275:10</p> <p><b>appeared</b> [1] - 275:5</p> <p><b>appendix</b> [1] - 15:5</p> <p><b>Apple</b> [1] - 182:11</p> <p><b>applicable</b> [1] - 158:8</p> <p><b>application</b> [3] - 27:25, 62:16, 187:10</p> <p><b>applications</b> [1] - 103:18</p> <p><b>applied</b> [8] - 22:10, 108:14, 110:15, 136:25, 139:3, 139:14, 163:21, 172:10</p> <p><b>apply</b> [1] - 140:19</p> <p><b>applying</b> [1] - 213:24</p> <p><b>appropriate</b> [4] - 29:1, 30:14, 130:21, 218:2</p> <p><b>appropriately</b> [2] - 154:18, 164:3</p> <p><b>approval</b> [2] - 70:14, 72:15</p> <p><b>approved</b> [4] - 69:23, 70:12, 72:3</p> <p><b>approves</b> [1] - 93:9</p> <p><b>approximate</b> [1] - 16:11</p>
--	--	--	---	--

<p><b>Arabian</b> <sup>[1]</sup> - 157:10</p> <p><b>arbiter</b> <sup>[1]</sup> - 236:21</p> <p><b>arbitrary</b> <sup>[2]</sup> - 130:10, 268:6</p> <p><b>arbitration</b> <sup>[1]</sup> - 145:14</p> <p><b>architecture</b> <sup>[19]</sup> - 29:5, 29:11, 29:13, 30:3, 33:4, 33:5, 33:24, 34:9, 34:17, 35:24, 45:1, 55:17, 64:17, 179:5, 189:15, 202:1, 204:22, 242:1, 265:10</p> <p><b>architectures</b> <sup>[3]</sup> - 26:14, 32:7, 41:19</p> <p><b>archive</b> <sup>[2]</sup> - 81:15, 89:18</p> <p><b>Archive</b> <sup>[3]</sup> - 85:23, 86:3, 89:13</p> <p><b>Archive's</b> <sup>[1]</sup> - 86:20</p> <p><b>area</b> <sup>[8]</sup> - 26:12, 30:2, 47:7, 69:24, 190:16, 201:4, 207:12, 252:23</p> <p><b>areas</b> <sup>[5]</sup> - 44:2, 44:5, 70:3, 209:6, 259:12</p> <p><b>argue</b> <sup>[3]</sup> - 10:11, 95:13, 272:4</p> <p><b>arguing</b> <sup>[1]</sup> - 78:8</p> <p><b>argument</b> <sup>[4]</sup> - 98:15, 214:4, 229:17, 266:23</p> <p><b>arguments</b> <sup>[3]</sup> - 170:24, 185:11, 185:16</p> <p><b>arrived</b> <sup>[2]</sup> - 182:19, 236:1</p> <p><b>arriving</b> <sup>[2]</sup> - 219:18, 251:6</p> <p><b>arrows</b> <sup>[1]</sup> - 131:22</p> <p><b>art</b> <sup>[29]</sup> - 28:14, 28:18, 28:22, 29:2, 29:19, 32:9, 36:7, 36:11, 36:15, 36:21, 37:3, 63:2, 64:12, 64:15, 64:22, 110:8, 115:12, 170:21, 171:20, 177:9, 204:10, 204:17, 213:6, 227:14, 252:4, 256:11, 258:19, 259:4, 259:5</p> <p><b>article</b> <sup>[1]</sup> - 271:5</p> <p><b>arts</b> <sup>[1]</sup> - 17:2</p> <p><b>ASCII</b> <sup>[3]</sup> - 156:22, 157:6, 157:12</p> <p><b>ASIC</b> <sup>[8]</sup> - 190:22, 198:8, 199:5, 211:1,</p>	<p>212:24, 214:17, 251:8, 251:10</p> <p><b>ASICs</b> <sup>[1]</sup> - 231:22</p> <p><b>aside</b> <sup>[3]</sup> - 230:19, 252:15, 259:13</p> <p><b>assembled</b> <sup>[1]</sup> - 267:1</p> <p><b>assert</b> <sup>[1]</sup> - 144:2</p> <p><b>asserted</b> <sup>[4]</sup> - 115:13, 140:2, 140:9, 143:22</p> <p><b>assist</b> <sup>[1]</sup> - 11:20</p> <p><b>assisted</b> <sup>[1]</sup> - 12:3</p> <p><b>associated</b> <sup>[6]</sup> - 19:2, 61:21, 76:7, 96:10, 243:15, 250:10</p> <p><b>Association</b> <sup>[1]</sup> - 22:6</p> <p><b>assume</b> <sup>[16]</sup> - 7:16, 34:18, 51:9, 56:6, 65:21, 66:6, 87:23, 95:24, 96:17, 97:21, 101:11, 200:16, 214:1, 242:19, 245:24, 251:9</p> <p><b>assumes</b> <sup>[1]</sup> - 179:5</p> <p><b>assuming</b> <sup>[2]</sup> - 199:23, 223:3</p> <p><b>asynchronous</b> <sup>[1]</sup> - 128:18</p> <p><b>ATLAS</b> <sup>[1]</sup> - 100:23</p> <p><b>ATM</b> <sup>[3]</sup> - 45:24, 46:2, 216:18</p> <p><b>attached</b> <sup>[7]</sup> - 24:3, 86:18, 86:22, 87:13, 118:12, 118:15, 199:17</p> <p><b>attaches</b> <sup>[1]</sup> - 86:2</p> <p><b>attempt</b> <sup>[2]</sup> - 69:10, 175:9</p> <p><b>attorneys</b> <sup>[1]</sup> - 20:15</p> <p><b>audible</b> <sup>[1]</sup> - 108:3</p> <p><b>Audrey</b> <sup>[2]</sup> - 1:22, 275:3</p> <p><b>AUDREY</b> <sup>[1]</sup> - 275:25</p> <p><b>August</b> <sup>[3]</sup> - 1:15, 275:7, 275:20</p> <p><b>authentication</b> <sup>[1]</sup> - 99:20</p> <p><b>author</b> <sup>[13]</sup> - 20:24, 37:18, 37:24, 38:4, 38:5, 38:6, 38:11, 46:22, 46:25, 51:13, 74:4, 97:23</p> <p><b>authors</b> <sup>[3]</sup> - 10:11, 37:25, 182:9</p> <p><b>automatic</b> <sup>[2]</sup> - 72:23, 129:24</p> <p><b>automatically</b> <sup>[6]</sup> - 61:18, 81:3, 84:21, 85:8, 93:20, 204:6</p> <p><b>autonomously</b> <sup>[1]</sup> - 93:2</p>	<p><b>autonomy</b> <sup>[1]</sup> - 61:16</p> <p><b>auxiliary</b> <sup>[1]</sup> - 249:5</p> <p><b>availability</b> <sup>[3]</sup> - 58:25, 60:23, 62:2</p> <p><b>available</b> <sup>[16]</sup> - 44:21, 59:14, 59:18, 59:25, 60:17, 61:1, 62:25, 63:6, 68:25, 69:15, 72:10, 77:15, 78:7, 130:8, 210:18, 226:17</p> <p><b>Avenue</b> <sup>[1]</sup> - 2:5</p> <p><b>avoid</b> <sup>[8]</sup> - 9:2, 44:13, 74:25, 132:3, 175:10, 200:14, 201:20, 232:7</p> <p><b>avoiding</b> <sup>[1]</sup> - 191:8</p> <p><b>award</b> <sup>[1]</sup> - 24:19</p> <p><b>aware</b> <sup>[15]</sup> - 8:2, 12:15, 12:16, 13:10, 19:25, 32:13, 60:2, 60:3, 61:12, 68:8, 68:11, 96:13, 162:25, 255:22, 271:25</p>	<p><sup>[1]</sup> - 2:18</p> <p><b>became</b> <sup>[1]</sup> - 78:7</p> <p><b>become</b> <sup>[4]</sup> - 18:5, 61:7, 77:15, 266:2</p> <p><b>becomes</b> <sup>[1]</sup> - 249:25</p> <p><b>BEFORE</b> <sup>[2]</sup> - 1:2, 274:22</p> <p><b>beforehand</b> <sup>[4]</sup> - 51:14, 61:10, 176:1, 222:6</p> <p><b>begin</b> <sup>[1]</sup> - 34:15</p> <p><b>beginning</b> <sup>[6]</sup> - 1:21, 33:19, 57:17, 83:15, 129:3, 141:16</p> <p><b>behind</b> <sup>[5]</sup> - 26:3, 53:6, 53:24, 81:11, 249:3</p> <p><b>belief</b> <sup>[1]</sup> - 166:20</p> <p><b>belonged</b> <sup>[1]</sup> - 92:7</p> <p><b>belonging</b> <sup>[1]</sup> - 94:14</p> <p><b>below</b> <sup>[1]</sup> - 274:6</p> <p><b>benefit</b> <sup>[1]</sup> - 272:10</p> <p><b>Berkeley</b> <sup>[7]</sup> - 24:17, 30:6, 39:20, 41:24, 45:12, 45:23, 46:20</p> <p><b>Bernard</b> <sup>[1]</sup> - 39:24</p> <p><b>best</b> <sup>[3]</sup> - 46:21, 128:2, 172:10</p> <p><b>bet</b> <sup>[1]</sup> - 205:20</p> <p><b>better</b> <sup>[2]</sup> - 168:13, 186:25</p> <p><b>between</b> <sup>[31]</sup> - 16:18, 16:19, 31:10, 38:2, 77:14, 80:12, 84:17, 94:9, 96:22, 120:24, 125:12, 128:23, 137:17, 155:4, 161:1, 165:8, 171:2, 174:7, 188:11, 193:19, 201:24, 223:18, 228:22, 234:19, 244:16, 248:15, 249:8, 249:16, 249:22, 250:22, 261:7</p> <p><b>beyond</b> <sup>[3]</sup> - 18:12, 261:21, 265:17</p> <p><b>bi</b> <sup>[4]</sup> - 165:14, 165:21, 167:16, 193:21</p> <p><b>Bi</b> <sup>[1]</sup> - 166:1</p> <p><b>bi-directional</b> <sup>[4]</sup> - 165:14, 165:21, 167:16, 193:21</p> <p><b>Bi-directional</b> <sup>[1]</sup> - 166:1</p> <p><b>bibliographic</b> <sup>[1]</sup> - 60:10</p> <p><b>Big</b> <sup>[1]</sup> - 26:1</p> <p><b>big</b> <sup>[21]</sup> - 25:1, 31:23, 34:10, 41:4, 41:7,</p>	<p>48:25, 49:1, 55:25, 68:21, 74:21, 74:23, 75:1, 77:6, 84:16, 175:11, 177:6, 177:8, 186:20, 197:5, 232:21, 272:16</p> <p><b>bigger</b> <sup>[4]</sup> - 35:18, 55:1, 158:1, 158:3</p> <p><b>billion</b> <sup>[1]</sup> - 44:16</p> <p><b>Bin</b> <sup>[1]</sup> - 48:6</p> <p><b>BIOS</b> <sup>[1]</sup> - 178:10</p> <p><b>bit</b> <sup>[37]</sup> - 9:7, 16:17, 21:24, 29:5, 32:21, 125:9, 132:9, 140:14, 140:18, 140:25, 145:17, 147:13, 153:8, 156:9, 157:12, 158:1, 158:3, 163:12, 166:5, 168:13, 168:18, 168:25, 172:14, 178:4, 181:16, 185:24, 190:10, 192:10, 193:18, 195:23, 197:8, 213:14, 216:6, 223:15, 233:19, 240:1, 246:1</p> <p><b>bits</b> <sup>[65]</sup> - 30:13, 38:16, 116:15, 116:21, 117:2, 119:8, 119:20, 120:1, 121:6, 121:11, 122:19, 123:2, 123:11, 123:13, 137:19, 138:13, 139:8, 140:5, 144:12, 146:25, 148:2, 148:16, 148:20, 148:21, 151:10, 151:13, 152:14, 152:17, 153:4, 153:6, 154:9, 154:15, 157:13, 164:16, 165:11, 168:1, 180:13, 181:19, 184:5, 196:14, 224:2, 224:9, 224:15, 225:15, 225:17, 227:10, 235:5, 235:7, 238:8, 238:13, 238:15, 240:6, 248:4, 248:6, 258:3, 260:6, 262:8, 264:23, 264:25, 265:17, 267:3,</p>
---	--	---	--	---

## B

**B2** <sup>[1]</sup> - 1:12

**bachelor** <sup>[3]</sup> - 32:17, 32:20, 34:6

**bachelor's** <sup>[3]</sup> - 29:4, 29:6, 29:23

**bad** <sup>[3]</sup> - 53:23, 132:5, 251:22

**Bang** <sup>[1]</sup> - 26:1

**bank** <sup>[1]</sup> - 93:5

**Bar** <sup>[1]</sup> - 22:6

**base** <sup>[2]</sup> - 171:15, 178:13

**based** <sup>[15]</sup> - 28:10, 28:18, 41:11, 50:22, 58:6, 68:23, 106:5, 172:1, 178:10, 181:16, 189:17, 228:1, 232:1, 255:12, 257:14

**Based** <sup>[1]</sup> - 160:2

**basic** <sup>[1]</sup> - 189:7

**Basic** <sup>[1]</sup> - 128:7

**basics** <sup>[1]</sup> - 172:5

**basis** <sup>[4]</sup> - 56:21, 56:22, 60:18, 79:9

**bathroom** <sup>[3]</sup> - 57:15, 111:16, 111:17

**bay** <sup>[1]</sup> - 118:13

**bburoker@**  
**gibsondunn.com** <sup>[1]</sup> - 2:9  
**bdavis@cooley.com**



267:23 <b>block</b> [4] - 41:21, 130:14, 198:7, 251:12 <b>blocked</b> [1] - 81:2 <b>blocks</b> [4] - 31:25, 41:2, 244:9, 246:6 <b>blown</b> [1] - 197:8 <b>Blue</b> [2] - 31:22, 229:11 <b>BMBF</b> [1] - 91:10 <b>BOARD</b> [1] - 1:2 <b>Board</b> [14] - 56:14, 74:6, 108:9, 108:16, 108:19, 108:20, 108:23, 108:24, 108:25, 109:3, 109:5, 110:13, 110:18, 113:2 <b>board</b> [3] - 41:5, 49:24, 50:5 <b>Board's</b> [1] - 110:16 <b>body</b> [1] - 55:23 <b>Bogaerts</b> [10] - 19:3, 20:25, 37:6, 37:18, 39:23, 60:11, 69:12, 78:21, 97:21, 97:22 <b>BOGAERTS</b> [1] - 97:22 <b>Bogart</b> [1] - 57:25 <b>boldface</b> [1] - 83:12 <b>book</b> [8] - 10:8, 10:12, 10:21, 10:22, 11:3, 11:5, 70:15, 264:10 <b>born</b> [1] - 4:18 <b>bother</b> [1] - 251:7 <b>bothering</b> [1] - 251:14 <b>bottom</b> [6] - 160:12, 183:3, 192:24, 197:14, 199:13, 213:19 <b>bought</b> [1] - 70:24 <b>bound</b> [1] - 14:6 <b>box</b> [7] - 152:13, 199:11, 199:16, 212:3, 221:2, 222:18, 237:22 <b>boxes</b> [5] - 79:15, 195:12, 206:5, 223:21, 237:19 <b>branch</b> [1] - 40:14 <b>break</b> [10] - 16:19, 57:18, 57:19, 132:8, 141:11, 141:18, 186:3, 242:3, 273:1 <b>breaking</b> [1] - 9:6 <b>BRI</b> [1] - 108:14 <b>BRIAN</b> [1] - 2:7 <b>Brian</b> [1] - 4:5 <b>Bridge</b> [1] - 160:3	<b>bridge</b> [26] - 38:18, 116:12, 116:20, 119:7, 160:19, 160:25, 161:5, 161:8, 161:19, 161:25, 162:4, 162:9, 162:14, 162:17, 162:22, 163:2, 163:4, 163:14, 167:25, 196:13, 196:21, 240:23, 258:2, 260:2, 260:5, 260:11 <b>bridges</b> [1] - 43:7 <b>Brief</b> [3] - 107:10, 111:23, 147:11 <b>brief</b> [3] - 57:20, 186:5, 242:6 <b>briefly</b> [1] - 91:21 <b>bring</b> [1] - 91:24 <b>BRITTON</b> [1] - 2:16 <b>Britton</b> [1] - 4:8 <b>broad</b> [1] - 52:12 <b>broadcast</b> [1] - 135:10 <b>broadcaster</b> [1] - 165:8 <b>broader</b> [3] - 65:3, 232:8, 255:15 <b>broadest</b> [18] - 107:17, 108:17, 109:6, 109:9, 109:13, 110:15, 110:20, 111:1, 111:3, 111:8, 113:8, 155:25, 163:20, 166:20, 168:4, 169:10, 240:4, 261:25 <b>broken</b> [4] - 87:24, 260:21, 261:4, 265:7 <b>Brookhaven</b> [2] - 42:7, 45:14 <b>Broomfield</b> [1] - 2:15 <b>browser</b> [1] - 85:8 <b>BS0</b> [1] - 153:5 <b>BS3</b> [1] - 153:5 <b>budget</b> [1] - 97:7 <b>buffer</b> [3] - 237:7, 237:10, 237:12 <b>buffer's</b> [1] - 235:13 <b>buffers</b> [5] - 235:18, 236:3, 236:6, 236:15, 238:18 <b>build</b> [11] - 27:23, 41:25, 44:11, 188:25, 191:18, 220:18, 228:15, 229:9, 260:17, 272:17 <b>building</b> [7] - 31:25,	35:11, 35:13, 41:21, 45:6, 57:6, 229:19 <b>builds</b> [1] - 82:24 <b>built</b> [19] - 25:2, 25:3, 27:20, 35:5, 35:16, 35:20, 50:9, 57:5, 79:18, 80:6, 101:7, 190:12, 202:22, 216:24, 217:7, 227:16, 227:18, 229:24, 261:7 <b>bulky</b> [1] - 133:2 <b>bump</b> [1] - 47:12 <b>bunch</b> [4] - 24:20, 132:24, 135:13, 264:1 <b>BUROKER</b> [173] - 2:7, 4:4, 4:14, 13:18, 14:8, 14:11, 32:4, 33:17, 34:14, 42:11, 46:9, 57:16, 57:21, 58:9, 59:15, 60:4, 63:8, 63:21, 64:13, 64:21, 67:11, 67:23, 68:4, 73:8, 75:22, 77:12, 81:24, 82:6, 85:19, 86:9, 86:15, 87:1, 87:10, 88:2, 89:10, 89:22, 91:2, 91:25, 92:14, 93:24, 94:19, 95:15, 96:24, 97:16, 98:4, 99:9, 99:22, 102:12, 103:2, 104:3, 104:14, 104:22, 105:12, 105:23, 107:11, 110:23, 111:6, 111:17, 111:21, 111:24, 112:3, 112:6, 115:21, 118:4, 119:10, 119:23, 121:18, 122:16, 124:8, 124:13, 124:19, 137:15, 138:3, 139:12, 141:11, 141:14, 142:10, 145:23, 147:12, 147:21, 149:19, 150:6, 150:12, 151:2, 153:23, 154:20, 155:5, 155:19, 162:19, 163:10, 164:20, 165:25, 167:6, 173:21, 176:2, 176:9, 179:14, 180:24, 181:25, 182:6, 185:13, 185:25,	186:6, 188:4, 190:7, 191:19, 195:15, 197:19, 198:2, 198:22, 199:8, 199:24, 200:21, 201:1, 202:9, 202:17, 203:6, 204:8, 204:20, 205:13, 205:16, 207:8, 214:6, 215:11, 217:11, 218:7, 218:21, 220:16, 223:23, 226:4, 227:5, 230:20, 235:8, 237:11, 239:16, 240:3, 240:19, 241:2, 241:9, 242:4, 242:7, 243:12, 245:4, 245:17, 246:13, 246:24, 247:18, 248:1, 250:3, 250:20, 254:1, 254:18, 255:2, 255:24, 256:20, 257:2, 257:21, 257:25, 258:13, 259:1, 259:18, 260:10, 260:25, 262:3, 263:12, 267:22, 268:13, 268:21, 268:25, 269:9, 270:3, 271:1, 272:25 <b>Buroker</b> [2] - 3:4, 4:6 <b>burst</b> [1] - 236:4 <b>bus</b> [292] - 112:15, 112:19, 112:23, 112:25, 113:4, 113:14, 113:15, 114:1, 114:2, 114:16, 114:17, 114:20, 114:22, 114:25, 115:11, 116:15, 116:21, 117:2, 117:18, 117:20, 118:3, 119:3, 120:1, 120:5, 121:22, 122:9, 122:12, 122:19, 123:3, 123:7, 123:11, 124:2, 124:11, 125:8, 126:9, 126:10, 127:13, 127:22, 128:11, 128:14, 128:15, 128:17, 128:18, 128:24, 129:8, 129:10, 129:21, 130:1, 130:14, 131:14,	131:23, 131:24, 132:1, 132:12, 133:11, 133:18, 133:19, 136:22, 137:2, 137:3, 137:5, 137:18, 137:19, 138:6, 138:13, 138:22, 139:8, 139:9, 139:10, 139:15, 139:18, 139:20, 140:5, 140:14, 140:18, 140:21, 140:22, 141:1, 141:5, 142:23, 143:6, 144:6, 144:7, 144:12, 145:20, 146:1, 146:4, 146:6, 146:8, 146:25, 147:3, 147:9, 147:16, 147:19, 148:2, 149:7, 149:22, 149:24, 150:8, 150:9, 150:14, 150:17, 151:10, 151:12, 151:13, 151:15, 152:14, 152:17, 152:23, 153:4, 154:1, 154:6, 154:11, 154:25, 155:14, 155:15, 155:17, 160:8, 160:17, 161:7, 161:9, 164:16, 164:24, 165:11, 165:12, 165:15, 165:20, 167:2, 168:1, 168:9, 169:1, 169:3, 174:2, 174:3, 174:13, 174:16, 174:23, 175:4, 175:8, 175:15, 175:19, 175:21, 176:6, 176:12, 179:11, 180:19, 180:20, 181:21, 185:5, 187:24, 188:23, 189:4, 189:21, 190:14, 191:9, 191:13, 191:15, 193:6, 193:16, 193:21, 193:22, 194:6, 194:20, 195:3, 195:4, 195:5, 195:6, 196:8, 197:3, 197:21, 198:8, 198:9, 198:12, 199:4, 199:6, 199:21, 199:25,
--	---	--	---	---

202:14, 204:24,  
205:2, 205:3, 205:9,  
205:24, 206:13,  
206:17, 206:19,  
207:6, 207:10,  
208:6, 209:10,  
209:11, 211:9,  
214:24, 214:25,  
215:7, 215:10,  
215:13, 215:21,  
217:20, 217:24,  
217:25, 218:1,  
218:11, 218:18,  
218:23, 219:7,  
219:23, 220:18,  
221:23, 222:1,  
235:24, 236:20,  
236:21, 236:23,  
236:25, 237:15,  
237:17, 237:18,  
237:20, 237:21,  
237:22, 237:25,  
238:24, 239:7,  
239:11, 239:12,  
239:23, 240:8,  
240:24, 241:18,  
241:24, 242:14,  
242:18, 242:24,  
242:25, 243:1,  
243:5, 243:19,  
243:20, 243:22,  
244:3, 244:16,  
244:20, 246:15,  
247:10, 247:13,  
247:21, 248:5,  
250:5, 250:17,  
250:24, 251:8,  
253:5, 253:8,  
254:13, 254:20,  
255:3, 255:14,  
255:15, 255:18,  
255:20, 257:15,  
257:17, 258:11,  
258:20, 259:6,  
259:20, 260:4,  
260:6, 260:12,  
261:2, 261:10,  
261:14, 261:18,  
261:23, 262:6,  
262:17, 262:22,  
263:15, 267:19,  
268:17, 268:23,  
269:12, 270:6,  
270:10  
**Bus** [4] - 181:12,  
181:17, 183:24,  
236:23  
**buses** [3] - 198:13,  
198:15, 248:17  
**business** [3] - 4:20,  
4:21, 172:8

**businesses** [1] - 9:8  
**buy** [4] - 32:2, 49:3,  
71:14, 93:18  
**buying** [2] - 8:12,  
71:23  
**buys** [1] - 72:5  
**buzzwords** [1] - 33:13  
**BY** [158] - 4:14, 13:18,  
14:11, 32:4, 33:17,  
34:14, 42:11, 46:9,  
57:21, 58:9, 59:15,  
60:4, 63:8, 63:21,  
64:13, 64:21, 67:11,  
67:23, 68:4, 73:8,  
75:22, 77:12, 81:24,  
82:6, 85:19, 86:9,  
86:15, 87:1, 87:10,  
88:2, 89:10, 89:22,  
91:2, 91:25, 92:14,  
93:24, 94:19, 95:15,  
96:24, 97:16, 98:4,  
99:9, 99:22, 102:12,  
103:2, 104:3,  
104:14, 104:22,  
105:12, 105:23,  
107:11, 110:23,  
111:6, 111:24,  
112:6, 115:21,  
118:4, 119:10,  
119:23, 121:18,  
122:16, 124:8,  
124:13, 124:19,  
137:15, 138:3,  
139:12, 141:14,  
145:23, 147:12,  
147:21, 149:19,  
150:6, 150:12,  
151:2, 153:23,  
154:20, 155:5,  
155:19, 162:19,  
163:10, 164:20,  
165:25, 167:6,  
173:21, 176:2,  
176:9, 180:24,  
181:25, 182:6,  
185:13, 186:6,  
188:4, 190:7,  
191:19, 195:15,  
197:19, 198:2,  
198:22, 199:8,  
199:24, 200:21,  
202:9, 202:17,  
203:6, 204:8,  
204:20, 205:16,  
207:8, 214:6,  
215:11, 217:11,  
218:7, 218:21,  
220:16, 223:23,  
226:4, 227:5,  
230:20, 235:8,

237:11, 239:16,  
240:3, 240:19,  
241:2, 241:9, 242:7,  
243:12, 245:4,  
245:17, 246:13,  
246:24, 247:18,  
248:1, 250:3,  
250:20, 254:1,  
254:18, 255:2,  
255:24, 256:20,  
257:2, 257:21,  
257:25, 258:13,  
259:1, 259:18,  
260:10, 260:25,  
262:3, 263:12,  
267:22, 268:13,  
268:21, 268:25,  
269:9, 270:3, 271:1  
**byte** [21] - 113:17,  
114:6, 114:24,  
122:4, 122:8,  
122:13, 123:3,  
123:12, 126:11,  
127:15, 130:22,  
132:13, 137:6,  
141:6, 143:1,  
146:11, 205:23,  
223:9, 233:20,  
238:8, 248:3  
**byte-wide** [1] - 205:23  
**bytes** [8] - 222:18,  
238:9, 244:5, 244:9,  
244:10, 245:20,  
246:6, 247:7

## C

**Cabinet** [2] - 234:19,  
234:20  
**cable** [8] - 203:16,  
203:23, 204:1,  
204:2, 204:5,  
230:11, 231:6,  
231:25  
**cache** [15] - 130:24,  
136:13, 219:9,  
219:12, 248:25,  
249:18, 252:10,  
252:18, 253:9,  
253:10, 253:12,  
253:14, 253:15,  
265:14, 272:6  
**cached** [1] - 252:12  
**caches** [4] - 252:9,  
253:1, 253:16  
**calculate** [2] - 35:6,  
232:22  
**California** [3] - 39:20,  
68:25, 69:3  
**campaign** [1] - 75:1

**candidate** [2] - 42:2,  
45:10  
**cannot** [23] - 22:1,  
51:16, 74:12, 77:16,  
93:20, 97:5, 98:16,  
103:1, 115:2,  
120:17, 131:20,  
146:14, 171:15,  
197:6, 204:15,  
220:12, 222:24,  
227:2, 229:19,  
235:25, 250:2,  
256:14, 267:15  
**capable** [4] - 120:11,  
120:14, 120:19,  
120:20  
**capital** [2] - 156:25,  
233:20  
**caps** [1] - 205:14  
**captured** [2] - 81:14,  
211:21  
**card** [4] - 49:12, 50:6,  
50:22, 50:24  
**card** [1] - 49:16  
**cards** [1] - 69:8  
**care** [1] - 219:10  
**career** [1] - 216:3  
**careful** [7] - 72:13,  
196:1, 197:17,  
200:25, 246:1,  
248:18, 251:3  
**carefully** [4] - 15:2,  
15:7, 31:24, 107:8  
**Carmelite** [1] - 1:20  
**case** [54] - 6:23, 9:1,  
9:4, 9:11, 9:12, 10:1,  
10:25, 11:1, 11:10,  
20:21, 23:5, 25:25,  
36:3, 48:12, 53:20,  
55:14, 70:23, 74:6,  
74:20, 93:8, 108:21,  
117:17, 124:10,  
126:14, 129:23,  
131:15, 143:1,  
161:7, 162:3,  
163:24, 168:10,  
173:4, 183:1,  
188:24, 189:4,  
189:11, 189:13,  
205:6, 210:6,  
225:13, 242:13,  
247:4, 248:24,  
249:7, 251:14,  
256:7, 261:6, 261:8,  
265:5, 266:9,  
268:10, 268:11,  
269:20, 269:22  
**Case** [2] - 1:12, 1:13  
**cases** [14] - 6:21, 6:24,  
7:2, 8:10, 9:2, 9:7,

36:25, 98:19,  
108:18, 109:3,  
139:22, 143:11,  
162:16, 163:6  
**cataloged** [1] - 63:11  
**caused** [1] - 229:15  
**causing** [1] - 237:1  
**caveat** [1] - 229:8  
**caveats** [1] - 242:11  
**cds.cern.ch** [2] - 96:2,  
96:14  
**ceased** [1] - 255:4  
**Center** [1] - 5:4  
**centric** [1] - 179:4  
**CERN** [136] - 21:15,  
39:21, 39:23, 40:5,  
40:13, 42:21, 43:16,  
45:2, 46:5, 46:15,  
46:16, 46:18, 47:16,  
47:20, 47:23, 48:24,  
49:2, 49:4, 49:8,  
50:10, 50:17, 53:2,  
53:5, 54:25, 58:2,  
60:10, 60:17, 60:20,  
60:22, 60:25, 61:2,  
61:3, 61:4, 61:5,  
61:6, 61:8, 61:9,  
61:11, 61:12, 61:13,  
61:17, 61:19, 63:7,  
64:17, 65:7, 65:11,  
65:14, 65:20, 66:9,  
67:13, 67:18, 68:16,  
69:4, 69:11, 69:16,  
69:20, 70:1, 70:4,  
70:6, 70:7, 70:13,  
70:23, 71:17, 72:9,  
72:19, 73:4, 74:13,  
74:17, 74:24, 75:2,  
77:8, 77:10, 81:2,  
89:1, 90:16, 90:17,  
90:19, 90:24, 91:8,  
91:11, 91:13, 91:14,  
91:20, 92:8, 92:10,  
92:23, 92:24, 93:4,  
93:6, 93:12, 93:13,  
93:15, 93:16, 93:22,  
93:23, 94:20, 94:22,  
94:23, 95:2, 95:12,  
95:13, 95:17, 95:18,  
95:19, 95:20, 95:22,  
96:9, 96:10, 96:12,  
96:15, 96:18, 96:20,  
97:7, 97:11, 97:25,  
100:3, 100:7,  
100:18, 104:8,  
105:4, 105:5, 105:6,  
105:17, 105:21,  
106:5  
**cern.ch** [5] - 91:5,  
91:16, 92:4, 95:9,

<p>95:11</p> <p><b>CERN/LHCC</b> [1] - 56:4</p> <p><b>certain</b> [22] - 6:22, 47:10, 70:18, 71:12, 81:19, 83:9, 90:8, 98:18, 99:1, 99:2, 130:14, 137:23, 212:15, 219:8, 219:17, 221:6, 224:23, 232:5, 234:25, 236:5, 244:4</p> <p><b>certainly</b> [23] - 32:14, 33:12, 38:17, 38:25, 39:3, 42:17, 50:15, 51:2, 67:4, 69:4, 97:20, 125:3, 134:8, 134:16, 193:12, 232:10, 244:4, 253:17, 268:11, 269:22, 271:11</p> <p><b>CERTIFICATION</b> [1] - 275:1</p> <p><b>certify</b> [4] - 274:2, 274:4, 275:4, 275:14</p> <p><b>cetera</b> [5] - 146:4, 167:22, 169:5</p> <p><b>chain</b> [2] - 170:23, 214:4</p> <p><b>chair</b> [1] - 26:25</p> <p><b>Chair</b> [1] - 46:22</p> <p><b>chaired</b> [1] - 38:14</p> <p><b>chamber</b> [1] - 260:12</p> <p><b>chance</b> [1] - 53:11</p> <p><b>change</b> [2] - 204:7, 220:5</p> <p><b>changed</b> [3] - 50:21, 74:5, 204:3</p> <p><b>changes</b> [2] - 125:11, 187:9</p> <p><b>channel</b> [19] - 45:25, 46:3, 116:9, 116:11, 118:20, 118:25, 119:14, 119:22, 140:11, 166:16, 167:2, 167:12, 167:21, 167:24, 196:6, 197:3, 260:5, 260:8</p> <p><b>channel"</b> [1] - 116:4</p> <p><b>channels</b> [8] - 116:10, 119:1, 136:20, 165:4, 166:25, 175:2, 189:5, 196:7</p> <p><b>chapters</b> [1] - 38:17</p> <p><b>character</b> [1] - 157:12</p> <p><b>characters</b> [1] - 157:14</p> <p><b>cheap</b> [1] - 44:17</p> <p><b>cheaper</b> [1] - 44:7</p> <p><b>check</b> [9] - 16:9,</p>	<p>30:24, 43:3, 47:5, 89:6, 142:22, 178:7, 190:4, 196:4</p> <p><b>checked</b> [3] - 6:6, 39:2, 127:6</p> <p><b>Chinese</b> [1] - 48:7</p> <p><b>chip</b> [2] - 160:6, 198:16</p> <p><b>chips</b> [2] - 40:9, 182:21</p> <p><b>choke</b> [1] - 88:10</p> <p><b>choose</b> [2] - 29:6, 92:3</p> <p><b>chopped</b> [1] - 88:11</p> <p><b>chose</b> [3] - 26:11, 91:15, 223:16</p> <p><b>chosen</b> [3] - 100:25, 209:24, 225:14</p> <p><b>Christopher</b> [2] - 85:23, 89:24</p> <p><b>Chu</b> [5] - 18:23, 170:3, 171:12, 171:14, 172:18</p> <p><b>chunks</b> [1] - 238:24</p> <p><b>circuit</b> [1] - 132:5</p> <p><b>Circuit</b> [1] - 22:6</p> <p><b>circuitry</b> [1] - 163:8</p> <p><b>circulated</b> [1] - 38:19</p> <p><b>circumstances</b> [2] - 178:16, 261:1</p> <p><b>citation</b> [3] - 58:11, 98:14, 128:3</p> <p><b>citations</b> [2] - 20:6, 98:17</p> <p><b>cite</b> [15] - 20:1, 58:5, 59:2, 62:3, 76:18, 98:10, 114:4, 123:17, 125:20, 127:7, 127:13, 156:6, 158:6, 184:1, 187:2</p> <p><b>cited</b> [8] - 71:7, 105:3, 105:15, 157:21, 170:20, 177:9, 183:1, 256:11</p> <p><b>cites</b> [1] - 102:14</p> <p><b>citing</b> [3] - 102:20, 104:4, 104:6</p> <p><b>claim</b> [98] - 107:16, 108:14, 110:5, 116:2, 116:8, 117:19, 117:22, 118:7, 118:8, 118:13, 118:21, 119:9, 119:11, 120:8, 120:18, 121:5, 121:21, 122:2, 122:7, 123:5, 133:8, 136:16, 136:18, 137:19, 138:16, 139:7,</p>	<p>139:14, 139:23, 139:24, 140:3, 140:8, 140:9, 143:5, 146:18, 146:22, 150:4, 151:18, 154:23, 159:6, 159:10, 160:19, 161:4, 161:11, 161:12, 161:17, 161:22, 161:24, 162:5, 162:11, 163:12, 163:18, 163:25, 164:8, 164:12, 165:2, 166:9, 166:11, 166:12, 166:21, 167:9, 167:18, 168:6, 168:12, 172:1, 172:2, 172:7, 173:23, 174:21, 174:25, 176:4, 187:16, 187:17, 188:3, 188:15, 188:19, 195:16, 195:23, 197:4, 197:5, 233:10, 233:11, 233:24, 234:14, 256:21, 257:1, 258:10, 258:14, 258:18, 258:19, 259:3, 259:22, 260:14, 261:16, 261:18</p> <p><b>Claim</b> [1] - 112:9</p> <p><b>claim's</b> [1] - 123:14</p> <p><b>claims</b> [31] - 89:18, 114:11, 114:14, 114:15, 114:19, 115:12, 115:15, 118:6, 126:8, 133:17, 135:12, 137:23, 140:3, 145:21, 146:3, 146:5, 149:20, 162:23, 163:22, 171:19, 172:12, 173:16, 173:20, 173:22, 174:13, 185:17, 185:18, 187:15, 240:22, 256:10, 259:10</p> <p><b>clarification</b> [4] - 31:14, 45:16, 165:23, 203:24</p> <p><b>clarify</b> [7] - 7:13, 34:7, 97:1, 98:5, 108:5, 110:2, 243:14</p> <p><b>clarity</b> [1] - 52:14</p> <p><b>class</b> [5] - 10:8, 34:8, 34:10, 248:19,</p>	<p>248:20</p> <p><b>classes</b> [1] - 32:20</p> <p><b>clause</b> [6] - 138:23, 159:8, 163:16, 167:23, 168:19, 168:20</p> <p><b>clean</b> [1] - 174:6</p> <p><b>clear</b> [40] - 5:12, 10:16, 20:16, 22:12, 24:9, 26:22, 43:13, 44:10, 45:21, 47:12, 52:13, 60:24, 71:4, 77:24, 80:11, 95:7, 106:14, 108:23, 109:24, 110:2, 110:13, 111:13, 112:1, 114:19, 126:1, 133:14, 150:20, 164:11, 166:8, 172:16, 173:3, 191:5, 209:2, 220:11, 230:21, 246:10, 250:1, 251:2, 264:22</p> <p><b>clearly</b> [11] - 11:7, 48:4, 127:24, 163:5, 175:1, 182:25, 187:11, 196:19, 199:1, 257:9, 260:1</p> <p><b>click</b> [3] - 81:21, 82:18, 82:20</p> <p><b>clock</b> [17] - 128:9, 128:22, 129:2, 129:4, 129:12, 131:20, 131:21, 143:23, 154:17, 180:9, 181:14, 193:22, 235:21, 238:6, 238:7, 238:18</p> <p><b>close</b> [5] - 9:13, 17:19, 40:14, 47:23, 47:24</p> <p><b>CMS</b> [1] - 100:23</p> <p><b>co</b> [2] - 20:24, 37:24</p> <p><b>co-author</b> [2] - 20:24, 37:24</p> <p><b>code</b> [18] - 4:25, 5:5, 96:19, 153:21, 156:12, 156:16, 156:17, 156:22, 156:25, 157:3, 157:6, 157:12, 157:13, 157:15, 158:5, 158:24, 222:23, 222:25</p> <p><b>code"</b> [1] - 158:6</p> <p><b>coded</b> [2] - 156:15, 156:18</p> <p><b>codes</b> [3] - 48:14, 156:23, 157:5</p> <p><b>coding</b> [4] - 56:9,</p>	<p>157:16, 158:18, 259:15</p> <p><b>coherency</b> [5] - 219:9, 219:12, 249:1, 249:18, 272:6</p> <p><b>coherent</b> [3] - 45:9, 253:15, 272:8</p> <p><b>cold</b> [1] - 74:19</p> <p><b>Collaboration</b> [2] - 42:4, 73:19</p> <p><b>collaboration</b> [3] - 101:20, 101:25, 102:7</p> <p><b>collaborations</b> [1] - 106:16</p> <p><b>colleagues</b> [1] - 19:2</p> <p><b>collect</b> [1] - 178:9</p> <p><b>Collider</b> [2] - 45:14, 45:18</p> <p><b>collision</b> [2] - 177:3, 209:22</p> <p><b>collisions</b> [1] - 155:8</p> <p><b>Colorado</b> [1] - 2:15</p> <p><b>column</b> [7] - 143:23, 180:25, 181:1, 181:2, 181:10, 184:2, 187:3</p> <p><b>combination</b> [1] - 199:15</p> <p><b>combinations</b> [1] - 31:19</p> <p><b>combined</b> [2] - 31:17, 143:1</p> <p><b>comfortably</b> [1] - 217:9</p> <p><b>coming</b> [4] - 165:18, 220:20, 237:9, 251:15</p> <p><b>command</b> [33] - 84:9, 84:13, 113:16, 114:2, 114:23, 115:3, 121:8, 121:19, 121:22, 123:2, 123:11, 126:10, 126:23, 127:13, 129:5, 129:14, 130:22, 132:12, 132:15, 135:10, 136:1, 137:5, 138:11, 138:15, 138:21, 141:6, 143:20, 210:21, 211:3, 243:19, 244:21, 245:7, 248:2</p> <p><b>command"</b> [1] - 221:10</p> <p><b>commands</b> [12] - 83:9, 83:11, 83:20, 84:11, 130:1, 130:6, 185:5,</p>
--	---	--	--	---

<p>189:17, 210:9, 221:6, 222:6, 248:10</p> <p><b>commas</b> [1] - 15:10</p> <p><b>commencement</b> [1] - 275:8</p> <p><b>commercial</b> [1] - 193:9</p> <p><b>committed</b> [1] - 11:2</p> <p><b>Committee</b> [11] - 46:22, 52:3, 52:9, 58:3, 66:9, 67:6, 73:10, 73:13, 73:24, 182:10</p> <p><b>committee</b> [19] - 52:16, 52:25, 53:2, 56:24, 58:24, 60:15, 66:16, 66:17, 66:22, 70:7, 70:8, 70:10, 72:22, 73:3, 73:5, 73:9, 74:5, 75:10</p> <p><b>common</b> [3] - 95:3, 193:20, 234:13</p> <p><b>communicate</b> [38] - 114:22, 116:20, 117:20, 117:22, 119:7, 119:25, 120:5, 121:6, 121:22, 122:8, 122:18, 123:1, 123:10, 126:21, 133:9, 147:16, 147:18, 148:1, 149:12, 163:13, 163:15, 163:18, 163:21, 166:10, 196:13, 197:3, 206:12, 210:8, 210:14, 216:13, 240:23, 242:10, 242:23, 257:7, 258:3, 258:6, 260:6, 261:7</p> <p><b>communicated</b> [11] - 114:25, 117:15, 123:13, 154:23, 168:9, 175:6, 189:4, 231:18, 259:6, 270:7, 270:9</p> <p><b>communicates</b> [1] - 164:1</p> <p><b>communicating</b> [9] - 114:15, 119:19, 140:13, 146:24, 168:23, 175:14, 175:21, 175:24, 181:7</p> <p><b>communication</b> [23] - 32:8, 33:24, 34:17, 35:25, 122:3, 148:10, 148:13,</p>	<p>148:18, 153:7, 164:4, 164:9, 165:4, 165:7, 165:10, 165:14, 165:20, 175:12, 175:17, 194:2, 214:15, 227:22, 229:1</p> <p><b>communications</b> [2] - 18:16, 18:19</p> <p><b>community</b> [1] - 47:9</p> <p><b>companies</b> [2] - 9:8, 97:10</p> <p><b>Company</b> [2] - 271:19, 271:23</p> <p><b>comparably</b> [1] - 238:7</p> <p><b>compare</b> [2] - 87:8, 258:18</p> <p><b>compared</b> [3] - 31:20, 115:12, 128:18</p> <p><b>compares</b> [1] - 253:7</p> <p><b>comparison</b> [3] - 87:21, 88:25, 89:5</p> <p><b>compensated</b> [2] - 15:20, 15:24</p> <p><b>Competent</b> [1] - 175:3</p> <p><b>competent</b> [1] - 256:12</p> <p><b>compilation</b> [1] - 88:25</p> <p><b>compiled</b> [2] - 39:8, 40:21</p> <p><b>complete</b> [12] - 53:24, 67:2, 84:5, 98:3, 131:4, 146:23, 169:7, 188:23, 211:12, 220:12, 245:12, 256:19</p> <p><b>completely</b> [6] - 58:15, 81:2, 171:7, 189:9, 209:10</p> <p><b>complex</b> [15] - 53:11, 55:20, 70:2, 85:16, 96:22, 190:22, 190:24, 201:22, 201:23, 209:19, 212:19, 213:8, 213:11, 216:20, 264:2</p> <p><b>complexity</b> [6] - 178:25, 190:20, 209:25, 212:25, 221:14, 272:6</p> <p><b>compliance</b> [1] - 6:21</p> <p><b>compliant</b> [6] - 120:13, 149:12, 149:16, 214:5, 214:20, 214:24</p> <p><b>complicated</b> [9] - 37:9, 74:9, 93:1,</p>	<p>96:20, 156:9, 217:6, 219:2, 220:6, 265:11</p> <p><b>complications</b> [2] - 33:8, 175:10</p> <p><b>comply</b> [1] - 8:14</p> <p><b>Component</b> [4] - 113:3, 119:2, 136:22, 260:4</p> <p><b>component</b> [5] - 112:15, 137:1, 167:1, 198:14, 246:16</p> <p><b>components</b> [6] - 192:6, 193:3, 197:9, 217:17, 250:8, 254:20</p> <p><b>compose</b> [2] - 221:22, 241:17</p> <p><b>comprises</b> [2] - 119:17, 119:20</p> <p><b>comprising</b> [6] - 116:9, 118:24, 118:25, 196:5, 196:7, 196:10</p> <p><b>compute</b> [1] - 224:23</p> <p><b>Computer</b> [3] - 271:19, 271:23, 271:24</p> <p><b>computer</b> [93] - 24:23, 25:2, 25:3, 25:9, 26:8, 26:13, 26:17, 26:21, 26:25, 27:3, 27:5, 27:7, 27:8, 27:12, 27:17, 27:20, 28:2, 28:4, 29:5, 29:7, 29:8, 29:11, 29:13, 29:24, 30:3, 30:4, 30:7, 30:11, 30:12, 30:17, 31:4, 31:9, 31:10, 32:7, 32:17, 32:21, 33:4, 33:5, 33:10, 33:19, 33:23, 33:24, 34:8, 34:16, 34:17, 35:4, 35:10, 35:24, 44:4, 44:8, 44:25, 45:2, 48:21, 55:17, 64:16, 80:3, 80:23, 80:25, 90:18, 90:24, 91:13, 91:20, 92:6, 93:12, 93:15, 97:1, 118:12, 118:16, 160:4, 160:22, 161:3, 171:4, 171:7, 176:20, 177:12, 177:17, 177:20, 177:22, 177:25, 178:5, 185:8, 205:19, 216:8, 233:2, 252:19,</p>	<p>266:22</p> <p><b>computers</b> [19] - 8:12, 31:23, 35:13, 45:3, 80:5, 90:17, 91:7, 93:9, 93:14, 175:24, 179:7, 203:22, 204:5, 224:3, 224:22, 227:18, 232:23, 233:1, 265:4</p> <p><b>Computing</b> [1] - 56:14</p> <p><b>computing</b> [7] - 30:23, 32:6, 35:23, 107:3, 118:23, 216:8, 224:21</p> <p><b>conceived</b> [1] - 209:1</p> <p><b>concept</b> [2] - 28:17, 32:25</p> <p><b>concluded</b> [1] - 273:5</p> <p><b>conclusion</b> [6] - 67:8, 91:6, 93:20, 93:25, 101:22, 153:18</p> <p><b>conclusions</b> [2] - 14:24, 36:24</p> <p><b>concrete</b> [2] - 21:10, 21:13</p> <p><b>conditions</b> [4] - 70:18, 72:2, 132:3, 268:9</p> <p><b>conduct</b> [2] - 51:22, 259:11</p> <p><b>conference</b> [1] - 48:18</p> <p><b>conferences</b> [2] - 47:10, 51:5</p> <p><b>confidential</b> [12] - 12:8, 12:12, 12:24, 13:3, 19:7, 66:19, 98:11, 98:15, 98:25, 103:10, 104:11, 105:2</p> <p><b>confidentiality</b> [9] - 76:6, 76:10, 76:15, 76:19, 76:23, 104:19, 104:21, 105:10, 105:22</p> <p><b>configuration</b> [29] - 115:5, 129:24, 129:25, 130:12, 130:20, 133:25, 134:4, 134:8, 134:17, 134:18, 178:3, 178:4, 178:19, 187:14, 202:10, 208:14, 208:16, 209:6, 209:8, 210:17, 211:9, 212:20, 212:23, 212:24, 217:8, 242:9, 244:15, 248:13, 248:23</p> <p><b>configure</b> [2] - 134:1,</p>	<p>211:5</p> <p><b>configured</b> [5] - 219:24, 220:22, 220:25, 242:12, 249:8</p> <p><b>confined</b> [1] - 171:8</p> <p><b>confirm</b> [4] - 13:12, 24:2, 27:2, 155:13</p> <p><b>confirmed</b> [1] - 29:14</p> <p><b>confused</b> [2] - 120:24, 243:1</p> <p><b>confusing</b> [2] - 123:21, 233:21</p> <p><b>confusion</b> [1] - 248:17</p> <p><b>congestion</b> [1] - 201:21</p> <p><b>connect</b> [10] - 149:15, 171:9, 200:9, 201:6, 203:19, 203:22, 204:11, 205:9, 226:21, 242:25</p> <p><b>connected</b> [23] - 45:3, 143:17, 174:15, 174:17, 186:22, 197:13, 197:21, 199:21, 199:25, 202:12, 202:14, 202:15, 204:24, 206:2, 206:21, 208:3, 209:16, 214:14, 214:16, 216:25, 244:7, 253:21, 254:3</p> <p><b>Connecticut</b> [1] - 2:5</p> <p><b>connecting</b> [1] - 35:11</p> <p><b>connection</b> [13] - 11:20, 12:4, 14:14, 15:21, 36:3, 69:11, 161:8, 178:1, 202:24, 203:2, 203:15, 206:15, 233:1</p> <p><b>connections</b> [2] - 107:10, 147:11</p> <p><b>connectors</b> [2] - 49:22, 175:11</p> <p><b>consequence</b> [1] - 188:2</p> <p><b>consequently</b> [2] - 94:17, 185:11</p> <p><b>consider</b> [10] - 22:4, 35:22, 103:7, 109:5, 142:20, 216:4, 219:5, 232:8, 266:24, 269:5</p> <p><b>considered</b> [11] - 18:7, 29:20, 55:4, 62:6, 62:23, 63:13, 74:10, 81:1, 85:25, 160:22, 225:1</p>
--	--	---	---	---

<p><b>consist</b> <sup>[1]</sup> - 31:7</p> <p><b>consistent</b> <sup>[2]</sup> - 127:9, 235:6</p> <p><b>console</b> <sup>[7]</sup> - 118:13, 118:24, 166:16, 171:9, 186:22, 194:20, 196:5</p> <p><b>constantly</b> <sup>[2]</sup> - 39:22, 100:7</p> <p><b>constitute</b> <sup>[2]</sup> - 143:1, 175:7</p> <p><b>constitutes</b> <sup>[1]</sup> - 141:1</p> <p><b>construct</b> <sup>[1]</sup> - 138:25</p> <p><b>constructed</b> <sup>[4]</sup> - 168:12, 215:24, 261:6, 270:21</p> <p><b>construction</b> <sup>[4]</sup> - 108:13, 108:15, 112:12, 172:7</p> <p><b>Construction</b> <sup>[1]</sup> - 112:9</p> <p><b>construed</b> <sup>[2]</sup> - 113:2, 234:9</p> <p><b>consuming</b> <sup>[1]</sup> - 266:3</p> <p><b>contact</b> <sup>[2]</sup> - 46:12, 69:10</p> <p><b>contacted</b> <sup>[1]</sup> - 20:22</p> <p><b>contacts</b> <sup>[4]</sup> - 80:9, 91:13, 93:11, 272:21</p> <p><b>contain</b> <sup>[4]</sup> - 99:20, 185:4, 218:17, 225:5</p> <p><b>containing</b> <sup>[1]</sup> - 137:12</p> <p><b>contains</b> <sup>[2]</sup> - 66:19, 98:22</p> <p><b>contemplate</b> <sup>[1]</sup> - 149:21</p> <p><b>contemplated</b> <sup>[1]</sup> - 233:24</p> <p><b>contemplates</b> <sup>[4]</sup> - 151:9, 174:22, 189:20, 194:5</p> <p><b>contemplating</b> <sup>[1]</sup> - 237:14</p> <p><b>contends</b> <sup>[1]</sup> - 195:12</p> <p><b>content</b> <sup>[4]</sup> - 15:11, 51:23, 97:2, 265:24</p> <p><b>contents</b> <sup>[2]</sup> - 93:14, 95:21</p> <p><b>context</b> <sup>[59]</sup> - 6:17, 6:18, 8:10, 12:19, 19:8, 20:23, 33:6, 45:11, 70:6, 83:14, 94:6, 96:6, 114:19, 115:6, 121:25, 124:2, 126:1, 131:2, 139:17, 150:3, 150:5, 157:16, 158:19, 158:21, 159:10, 163:3,</p>	<p>163:18, 167:9, 168:6, 169:14, 170:25, 171:8, 171:11, 174:1, 174:5, 177:7, 183:8, 188:8, 190:5, 190:6, 200:17, 211:12, 214:10, 219:11, 220:10, 220:12, 220:13, 224:15, 227:20, 232:9, 233:4, 237:18, 238:19, 240:15, 249:12, 249:15, 259:25, 265:5, 272:19</p> <p><b>continue</b> <sup>[2]</sup> - 250:4, 255:8</p> <p><b>contracts</b> <sup>[1]</sup> - 93:1</p> <p><b>contradiction</b> <sup>[1]</sup> - 138:25</p> <p><b>contribute</b> <sup>[2]</sup> - 38:23, 41:13</p> <p><b>contributed</b> <sup>[1]</sup> - 38:9</p> <p><b>contributing</b> <sup>[1]</sup> - 42:13</p> <p><b>contributions</b> <sup>[1]</sup> - 97:8</p> <p><b>control</b> <sup>[14]</sup> - 129:17, 142:18, 142:21, 143:4, 145:1, 145:14, 145:18, 146:4, 146:14, 169:4, 215:6, 236:11, 239:4, 248:3</p> <p><b>controller</b> <sup>[17]</sup> - 191:25, 192:1, 192:24, 192:25, 193:16, 193:17, 193:21, 213:18, 214:7, 214:9, 214:18, 214:19, 215:1, 216:18, 242:2, 244:8</p> <p><b>controller"</b> <sup>[1]</sup> - 213:24</p> <p><b>conversation</b> <sup>[1]</sup> - 17:5</p> <p><b>conversations</b> <sup>[1]</sup> - 17:8</p> <p><b>converted</b> <sup>[2]</sup> - 149:24, 211:25</p> <p><b>converters</b> <sup>[1]</sup> - 84:21</p> <p><b>convey</b> <sup>[4]</sup> - 116:14, 167:19, 167:25, 168:5</p> <p><b>conveyed</b> <sup>[3]</sup> - 140:24, 168:10, 262:7</p> <p><b>conveying</b> <sup>[2]</sup> - 180:10, 188:23</p>	<p><b>convinced</b> <sup>[1]</sup> - 74:15</p> <p><b>convincing</b> <sup>[1]</sup> - 39:16</p> <p><b>cool</b> <sup>[1]</sup> - 53:8</p> <p><b>COOLEY</b> <sup>[1]</sup> - 2:12</p> <p><b>Cooley</b> <sup>[9]</sup> - 4:9, 14:25, 15:13, 17:3, 17:7, 19:6, 20:15, 20:18, 29:14</p> <p><b>cooperation</b> <sup>[1]</sup> - 47:22</p> <p><b>copied</b> <sup>[1]</sup> - 10:7</p> <p><b>copies</b> <sup>[8]</sup> - 13:19, 13:21, 14:17, 67:20, 68:7, 71:19, 86:19, 253:13</p> <p><b>copy</b> <sup>[11]</sup> - 14:4, 23:13, 51:21, 70:21, 78:15, 172:25, 173:8, 182:7, 252:13, 252:17, 252:18</p> <p><b>copyright</b> <sup>[1]</sup> - 61:21</p> <p><b>copyrighted</b> <sup>[1]</sup> - 72:14</p> <p><b>copyrights</b> <sup>[1]</sup> - 10:20</p> <p><b>core</b> <sup>[4]</sup> - 41:18, 42:15, 48:13, 161:3</p> <p><b>corollary</b> <sup>[4]</sup> - 51:2, 121:14, 142:24, 149:2</p> <p><b>CORPORATION</b> <sup>[1]</sup> - 1:5</p> <p><b>correct</b> <sup>[165]</sup> - 6:1, 6:4, 6:10, 6:11, 9:10, 11:13, 15:8, 15:15, 16:1, 16:24, 20:2, 22:17, 22:22, 23:14, 24:14, 25:14, 25:15, 27:3, 28:7, 28:20, 32:5, 32:12, 36:16, 37:20, 37:25, 42:20, 42:23, 51:21, 54:6, 56:19, 58:3, 58:7, 58:12, 59:3, 59:14, 61:24, 64:25, 65:7, 65:11, 65:16, 66:9, 74:16, 76:17, 76:20, 76:21, 77:4, 77:15, 77:16, 77:19, 77:20, 77:25, 78:1, 81:22, 82:3, 82:24, 86:5, 88:20, 89:16, 92:20, 94:2, 94:22, 95:23, 95:25, 96:11, 96:15, 97:5, 102:23, 103:10, 103:13, 104:7, 104:15, 105:17, 107:19, 107:23, 109:12, 109:14, 109:16,</p>	<p>110:16, 110:17, 112:12, 112:13, 112:17, 112:18, 113:5, 114:9, 115:13, 117:8, 117:11, 119:15, 120:22, 121:8, 121:23, 122:9, 123:6, 123:15, 125:7, 125:13, 126:3, 127:5, 135:20, 138:16, 141:21, 142:15, 144:13, 145:16, 147:4, 147:6, 151:10, 152:7, 152:19, 153:19, 156:2, 156:3, 158:12, 162:6, 167:13, 169:12, 172:21, 172:22, 173:13, 176:18, 176:20, 177:4, 177:5, 180:15, 188:7, 188:13, 188:14, 189:24, 190:8, 191:18, 192:6, 194:21, 195:13, 199:18, 199:23, 200:3, 200:7, 205:1, 205:5, 205:6, 206:15, 214:5, 218:6, 218:13, 218:14, 218:24, 221:3, 221:24, 222:11, 222:24, 224:18, 232:10, 239:14, 243:24, 244:22, 245:8, 250:10, 250:11, 256:3, 257:4, 258:11, 258:21, 268:12, 275:13</p> <p><b>correction</b> <sup>[4]</sup> - 222:21, 222:22, 222:24, 274:6</p> <p><b>Correction</b> <sup>[1]</sup> - 274:7</p> <p><b>correctly</b> <sup>[5]</sup> - 72:7, 81:17, 85:9, 137:14, 202:3</p> <p><b>correlation</b> <sup>[1]</sup> - 249:21</p> <p><b>corrupted</b> <sup>[1]</sup> - 229:14</p> <p><b>cost</b> <sup>[3]</sup> - 11:1, 44:11, 44:13</p> <p><b>costs</b> <sup>[2]</sup> - 72:5, 236:9</p> <p><b>Council</b> <sup>[1]</sup> - 91:10</p> <p><b>counsel</b> <sup>[12]</sup> - 7:9, 15:13, 17:7, 18:20,</p>	<p>20:18, 28:19, 75:8, 104:23, 107:23, 141:17, 275:10, 275:16</p> <p><b>count</b> <sup>[1]</sup> - 175:11</p> <p><b>country</b> <sup>[1]</sup> - 84:16</p> <p><b>couple</b> <sup>[6]</sup> - 55:2, 73:16, 116:19, 130:22, 204:2, 221:15</p> <p><b>coupled</b> <sup>[17]</sup> - 27:20, 119:5, 119:18, 119:21, 161:5, 161:14, 161:19, 162:1, 162:4, 162:5, 163:6, 196:20, 196:23, 203:11, 231:24, 260:2, 260:5</p> <p><b>course</b> <sup>[23]</sup> - 8:23, 9:4, 15:18, 17:23, 18:11, 36:24, 44:7, 65:3, 67:15, 70:23, 91:12, 96:13, 120:17, 130:4, 143:8, 155:14, 157:15, 178:15, 216:14, 224:15, 236:4, 239:1, 242:16</p> <p><b>courses</b> <sup>[1]</sup> - 28:5</p> <p><b>Court</b> <sup>[2]</sup> - 10:24, 275:25</p> <p><b>court</b> <sup>[13]</sup> - 6:25, 7:2, 7:17, 8:18, 9:5, 9:22, 10:3, 10:14, 31:13, 45:15, 165:22, 203:24, 275:3</p> <p><b>COURT</b> <sup>[2]</sup> - 205:15, 244:25</p> <p><b>cover</b> <sup>[1]</sup> - 117:13</p> <p><b>coversheet</b> <sup>[1]</sup> - 86:23</p> <p><b>CPU</b> <sup>[66]</sup> - 134:25, 195:11, 195:24, 196:23, 197:12, 206:1, 206:7, 206:12, 206:24, 208:20, 209:7, 210:8, 210:11, 210:13, 211:19, 211:22, 212:13, 212:16, 216:11, 217:16, 220:20, 221:21, 222:2, 222:14, 223:2, 223:21, 224:3, 224:7, 224:8, 224:10, 224:11, 224:12, 224:14, 224:19, 224:20, 226:23, 227:1, 227:16, 230:8,</p>
---	---	--	--	---

<p>230:17, 230:22, 239:21, 240:6, 240:12, 242:10, 249:15, 250:11, 250:17, 250:23, 250:24, 251:7, 251:14, 251:16, 251:24, 252:16, 253:20, 254:19, 255:18, 262:7, 262:19, 268:15, 268:19, 270:2 <b>CPU's</b> [1] - 228:8 <b>CPU/memory</b> [2] - 262:24, 270:8 <b>CPUs</b> [3] - 228:1, 243:16, 252:9 <b>crates</b> [1] - 50:1 <b>crawler</b> [1] - 81:5 <b>CRC</b> [2] - 222:19, 222:24 <b>create</b> [21] - 101:6, 154:13, 175:16, 186:17, 191:12, 193:15, 194:4, 194:11, 218:18, 218:23, 222:1, 238:23, 239:22, 240:17, 243:23, 244:2, 247:21, 250:16, 250:24, 269:12, 270:19 <b>created</b> [15] - 54:9, 101:16, 153:25, 175:7, 182:25, 216:19, 218:12, 230:8, 230:23, 232:7, 239:11, 246:8, 252:19, 254:12, 262:22 <b>creates</b> [2] - 178:10, 250:7 <b>creating</b> [2] - 189:16, 194:5 <b>creation</b> [1] - 174:22 <b>creative</b> [1] - 100:24 <b>Crescent</b> [1] - 2:13 <b>cross</b> [3] - 6:23, 61:2, 61:3 <b>cross-examination</b> [1] - 6:23 <b>crossover</b> [1] - 204:2 <b>Crutcher</b> [2] - 1:20, 4:6 <b>CRUTCHER</b> [1] - 2:4 <b>CSE/EE</b> [1] - 30:6 <b>current</b> [3] - 136:2, 231:23, 231:25 <b>curriculum</b> [2] - 32:19, 33:10</p>	<p><b>cutting</b> [2] - 26:13, 47:8 <b>cutting-edge</b> [2] - 26:13, 47:8 <b>CV</b> [3] - 23:13, 23:21, 24:3 <b>cycle</b> [13] - 131:23, 132:6, 134:11, 135:2, 135:20, 143:23, 144:3, 187:14, 209:8, 210:17, 210:19, 248:13 <b>cycle</b>" [1] - 210:16 <b>cycles</b> [8] - 129:25, 178:3, 178:19, 208:14, 208:16, 209:10, 211:10, 220:3</p> <p style="text-align: center;"><b>D</b></p> <p><b>daily</b> [1] - 53:21 <b>damage</b> [1] - 177:18 <b>damages</b> [1] - 72:16 <b>damaging</b> [1] - 99:5 <b>dangerous</b> [1] - 256:6 <b>Darmstadt</b> [1] - 5:4 <b>dash</b> [3] - 4:23, 101:10, 101:11 <b>dashed</b> [1] - 128:25 <b>data</b> [144] - 25:4, 25:5, 26:7, 26:9, 26:10, 27:17, 41:25, 45:4, 45:22, 60:10, 73:17, 83:21, 84:19, 106:9, 106:10, 113:17, 113:25, 114:6, 114:7, 114:17, 114:24, 116:10, 116:14, 116:21, 117:1, 119:2, 119:8, 119:19, 120:1, 121:6, 121:11, 122:12, 122:15, 122:19, 123:2, 123:11, 126:8, 126:11, 126:12, 127:15, 129:7, 129:9, 130:10, 130:16, 131:6, 131:8, 131:12, 131:13, 131:18, 131:25, 132:2, 132:11, 132:13, 133:10, 133:18, 136:21, 137:1, 137:4, 137:6, 137:10, 137:11, 137:18, 137:19,</p>	<p>137:24, 137:25, 138:5, 138:13, 138:22, 139:8, 139:10, 139:15, 139:19, 140:4, 140:5, 141:7, 142:23, 143:24, 144:5, 145:13, 146:3, 146:24, 148:1, 150:8, 164:16, 165:11, 165:17, 167:1, 167:8, 168:1, 168:22, 169:4, 175:3, 181:13, 196:8, 196:14, 222:18, 223:11, 225:1, 234:19, 235:10, 237:3, 237:9, 238:23, 240:5, 244:11, 244:19, 244:20, 244:22, 245:6, 245:8, 245:10, 245:14, 245:20, 246:2, 246:15, 246:16, 246:22, 247:9, 247:10, 247:11, 247:12, 248:6, 249:14, 249:19, 252:10, 252:11, 252:12, 253:12, 254:13, 258:3, 260:6, 270:5, 270:9 <b>Data</b> [2] - 3:11, 103:18 <b>data</b>" [2] - 139:11, 166:17 <b>database</b> [1] - 68:23 <b>date</b> [33] - 11:24, 11:25, 16:4, 16:7, 21:15, 34:20, 56:18, 56:23, 57:7, 57:11, 57:12, 57:24, 58:1, 58:2, 58:16, 58:19, 58:23, 58:24, 58:25, 59:5, 59:7, 59:23, 60:14, 60:19, 60:20, 62:16, 76:14, 77:17, 77:19, 110:9 <b>dated</b> [2] - 44:14, 87:22 <b>dates</b> [1] - 86:21 <b>Dave</b> [3] - 46:21, 182:9, 264:11 <b>DAVIS</b> [150] - 2:16, 4:8, 14:5, 14:10, 32:10, 34:1, 41:14, 58:8, 59:4, 59:19, 62:8, 63:20, 64:6,</p>	<p>64:19, 66:13, 67:22, 68:1, 73:7, 75:17, 77:5, 81:23, 82:5, 85:5, 86:6, 86:14, 86:24, 87:7, 87:18, 89:3, 89:17, 91:1, 91:19, 92:5, 92:21, 94:12, 95:10, 96:16, 97:4, 97:19, 98:12, 99:15, 101:17, 102:24, 103:22, 104:13, 104:16, 105:7, 105:18, 110:22, 111:2, 112:1, 117:23, 118:22, 119:16, 121:9, 122:10, 123:25, 124:17, 137:8, 137:21, 139:5, 142:8, 145:22, 147:10, 147:20, 149:8, 150:1, 150:10, 150:18, 153:1, 154:3, 155:3, 155:12, 162:13, 162:24, 164:19, 166:23, 173:18, 175:18, 176:8, 179:13, 180:21, 181:22, 182:5, 185:6, 187:21, 190:3, 191:16, 195:14, 197:16, 197:24, 198:21, 198:24, 199:19, 200:12, 201:2, 202:16, 202:19, 203:13, 204:13, 207:4, 213:21, 215:8, 215:22, 218:3, 218:20, 218:25, 223:13, 226:3, 226:10, 230:14, 234:21, 235:16, 239:15, 239:24, 240:9, 241:1, 241:6, 241:20, 243:2, 244:23, 245:9, 245:23, 246:20, 247:14, 247:23, 248:7, 250:19, 253:23, 254:17, 254:22, 255:21, 256:4, 256:24, 257:18, 257:24, 258:12, 258:22, 259:8, 259:24, 260:24, 261:17, 262:25, 267:21,</p>	<p>267:25, 268:20, 268:24, 269:2, 269:15, 270:12 <b>Davis</b> [1] - 4:8 <b>DAY</b> [1] - 274:23 <b>days</b> [4] - 55:2, 59:9, 204:4, 231:22 <b>DC</b> [1] - 2:6 <b>de</b> [2] - 126:17, 144:2 <b>de-assert</b> [1] - 144:2 <b>dead</b> [4] - 144:5, 177:21, 178:20, 208:13 <b>deadlock</b> [1] - 213:10 <b>debate</b> [2] - 71:20, 236:7 <b>debug</b> [1] - 33:16 <b>debugged</b> [1] - 229:19 <b>debugger</b> [1] - 229:15 <b>decay</b> [1] - 101:7 <b>decays</b> [1] - 101:4 <b>decide</b> [2] - 47:13, 51:1 <b>decided</b> [4] - 45:8, 47:24, 97:13, 193:9 <b>decision</b> [2] - 74:7, 109:5 <b>declaration</b> [54] - 14:13, 20:6, 20:20, 21:7, 21:24, 22:14, 24:6, 28:11, 28:13, 29:15, 36:4, 36:12, 37:15, 51:25, 56:17, 57:23, 63:18, 76:9, 76:12, 76:20, 78:13, 78:17, 83:15, 87:6, 96:5, 103:8, 103:15, 107:14, 124:25, 125:24, 127:7, 133:15, 146:2, 151:4, 159:24, 160:1, 169:20, 183:21, 185:15, 185:16, 186:8, 187:2, 187:5, 188:5, 194:18, 194:25, 218:9, 241:5, 264:9, 264:15, 264:18, 266:10, 266:12, 267:12 <b>declarations</b> [12] - 16:13, 18:6, 18:8, 18:10, 18:17, 19:15, 20:1, 20:7, 20:14, 20:18, 22:5, 23:12 <b>declare</b> [1] - 58:19 <b>declared</b> [1] - 98:24 <b>decode</b> [2] - 164:2, 164:3 <b>decoder</b> [3] - 157:19,</p>
---	--	--	--	--

<p>245:12, 245:16</p> <p><b>decoding</b> [1] - 236:16</p> <p><b>defend</b> [2] - 53:3, 53:4</p> <p><b>deficiencies</b> [1] - 253:25</p> <p><b>define</b> [9] - 121:14, 142:25, 143:9, 146:7, 146:9, 146:17, 154:7, 210:4, 239:25</p> <p><b>defined</b> [26] - 33:19, 36:7, 119:14, 120:12, 120:22, 121:25, 124:3, 130:7, 136:6, 147:5, 148:5, 148:8, 149:18, 165:12, 177:11, 177:14, 182:23, 200:13, 200:16, 204:10, 210:22, 214:2, 231:20, 248:22, 255:10, 261:19</p> <p><b>defines</b> [4] - 59:6, 129:3, 156:11, 179:6</p> <p><b>defining</b> [1] - 148:24</p> <p><b>definitely</b> [2] - 80:16, 186:25</p> <p><b>definition</b> [27] - 30:23, 36:10, 62:1, 154:14, 158:4, 158:17, 158:20, 162:18, 163:1, 180:16, 182:14, 182:16, 183:17, 183:19, 195:22, 203:17, 213:24, 225:16, 233:14, 234:2, 234:23, 255:18, 255:23, 256:9, 256:18, 263:2</p> <p><b>definitions</b> [2] - 132:16, 158:5</p> <p><b>degree</b> [12] - 25:6, 27:3, 27:4, 27:8, 27:10, 27:13, 28:3, 29:4, 29:7, 29:23, 33:21, 34:6</p> <p><b>degrees</b> [1] - 27:11</p> <p><b>delays</b> [3] - 44:1, 237:1</p> <p><b>deliver</b> [1] - 249:15</p> <p><b>delivered</b> [5] - 8:14, 8:15, 8:20, 38:16, 38:17</p> <p><b>demand</b> [1] - 187:13</p> <p><b>demonstration</b> [1] - 48:24</p> <p><b>depacketized</b> [1] - 237:13</p>	<p><b>depacketizer</b> [3] - 212:22, 238:16, 238:19</p> <p><b>department</b> [2] - 95:20</p> <p><b>dependable</b> [1] - 44:10</p> <p><b>depiction</b> [1] - 50:8</p> <p><b>DEPONENT</b> [1] - 274:1</p> <p><b>deposed</b> [2] - 6:16, 6:19</p> <p><b>Deposition</b> [1] - 1:19</p> <p><b>deposition</b> [13] - 5:13, 7:8, 16:21, 17:8, 17:22, 18:11, 18:18, 18:20, 130:2, 273:4, 275:5, 275:8, 275:12</p> <p><b>depth</b> [7] - 32:15, 33:14, 33:23, 67:14, 68:12, 89:4, 107:7</p> <p><b>derandomizing</b> [1] - 236:3</p> <p><b>describe</b> [1] - 217:15</p> <p><b>described</b> [4] - 171:2, 193:3, 200:23, 228:7</p> <p><b>describes</b> [1] - 199:1</p> <p><b>description</b> [2] - 83:4, 83:8</p> <p><b>Description</b> [1] - 3:9</p> <p><b>design</b> [1] - 251:12</p> <p><b>Design</b> [1] - 100:3</p> <p><b>designed</b> [1] - 135:8</p> <p><b>designing</b> [1] - 191:9</p> <p><b>destination</b> [5] - 201:18, 223:8, 223:10, 225:8, 227:9</p> <p><b>destination's</b> [2] - 225:22, 227:8</p> <p><b>destroying</b> [1] - 10:21</p> <p><b>detail</b> [8] - 15:18, 30:18, 113:21, 150:3, 202:5, 225:19, 234:15, 272:7</p> <p><b>detailed</b> [7] - 18:3, 138:1, 170:24, 193:23, 197:8, 212:21, 244:14</p> <p><b>details</b> [17] - 23:21, 37:1, 41:6, 42:18, 48:5, 52:11, 130:22, 148:22, 154:13, 191:4, 202:22, 214:13, 238:2, 243:9, 246:9, 264:21, 270:15</p> <p><b>detected</b> [1] - 80:24</p> <p><b>detection</b> [2] - 222:23, 222:25</p> <p><b>detector</b> [1] - 55:18</p>	<p><b>detectors</b> [1] - 55:19</p> <p><b>determination</b> [1] - 103:12</p> <p><b>determine</b> [3] - 69:12, 171:19, 204:11</p> <p><b>determined</b> [1] - 143:21</p> <p><b>develop</b> [3] - 44:25, 47:15, 216:7</p> <p><b>developed</b> [4] - 46:16, 49:6, 202:2, 208:25</p> <p><b>developing</b> [1] - 272:3</p> <p><b>development</b> [9] - 43:15, 43:16, 44:18, 44:23, 45:20, 48:14, 52:18, 53:25, 73:14</p> <p><b>device</b> [89] - 41:18, 41:23, 42:1, 48:4, 49:14, 119:6, 119:19, 129:18, 129:19, 129:21, 129:22, 129:23, 132:2, 134:24, 135:1, 143:4, 143:5, 145:4, 145:8, 145:12, 146:15, 149:16, 159:14, 174:10, 174:15, 176:4, 176:15, 176:22, 178:1, 178:6, 178:7, 178:9, 178:13, 179:1, 186:22, 187:11, 189:8, 189:16, 191:10, 196:11, 197:12, 197:13, 202:15, 206:12, 206:15, 206:20, 206:25, 207:19, 207:21, 208:3, 208:11, 208:15, 208:16, 208:18, 211:6, 211:8, 211:10, 211:11, 211:16, 213:20, 214:5, 214:9, 214:20, 218:2, 225:25, 226:1, 226:6, 226:8, 227:3, 239:13, 239:17, 240:8, 242:10, 242:13, 242:23, 244:6, 249:13, 254:13, 256:22, 256:25, 257:7, 257:17, 260:21, 261:2, 261:3, 261:8, 262:7, 262:18</p> <p><b>devices</b> [43] - 55:20, 126:20, 135:23,</p>	<p>149:12, 159:16, 160:21, 161:1, 163:9, 173:12, 174:16, 175:20, 175:23, 175:25, 177:14, 177:16, 177:20, 177:24, 178:17, 178:24, 179:2, 191:10, 194:1, 200:2, 201:11, 204:4, 205:10, 205:11, 208:5, 212:7, 214:23, 215:6, 215:9, 215:20, 216:8, 216:17, 225:9, 225:11, 226:20, 226:22, 268:17, 269:17, 272:13</p> <p><b>DEVSEL</b> [1] - 144:9</p> <p><b>diagram</b> [14] - 41:3, 130:17, 145:4, 152:1, 195:25, 198:7, 199:2, 202:6, 202:7, 207:13, 213:23, 214:13, 215:24, 264:12</p> <p><b>diagrams</b> [2] - 41:2, 131:6</p> <p><b>dial</b> [1] - 265:1</p> <p><b>dictates</b> [1] - 123:19</p> <p><b>dictionary</b> [4] - 156:6, 156:10, 157:21, 157:25</p> <p><b>difference</b> [7] - 39:21, 52:8, 137:16, 171:1, 188:10, 223:18, 249:16</p> <p><b>differences</b> [4] - 125:12, 172:18, 177:6, 184:6</p> <p><b>different</b> [82] - 11:8, 13:25, 16:13, 17:5, 30:13, 31:7, 31:17, 31:19, 31:20, 32:15, 38:5, 38:6, 42:20, 49:25, 50:11, 54:4, 55:15, 73:10, 73:12, 73:25, 75:10, 80:10, 81:18, 88:23, 89:9, 93:17, 96:22, 105:16, 105:20, 106:4, 109:25, 126:3, 126:20, 130:19, 130:20, 130:23, 131:5, 131:6, 133:10, 136:17, 147:23, 149:15, 153:12,</p>	<p>153:14, 153:20, 154:2, 157:11, 158:9, 160:15, 161:2, 161:24, 163:7, 168:7, 168:12, 178:4, 179:10, 182:24, 184:19, 189:6, 189:14, 191:2, 194:1, 196:17, 198:12, 199:3, 199:4, 201:15, 201:18, 207:25, 209:10, 210:20, 214:8, 217:3, 219:13, 225:14, 225:18, 228:1, 245:15, 261:22, 268:3, 273:1</p> <p><b>differential</b> [14] - 118:25, 140:11, 168:20, 180:5, 183:2, 183:9, 196:6, 231:12, 231:14, 231:18, 232:6, 232:9, 232:11, 232:19</p> <p><b>differentiated</b> [1] - 32:13</p> <p><b>differentiation</b> [2] - 120:10, 174:7</p> <p><b>differently</b> [2] - 177:19, 262:15</p> <p><b>difficult</b> [4] - 44:9, 98:16, 220:7, 256:13</p> <p><b>dig</b> [1] - 5:1</p> <p><b>Digital</b> [2] - 40:12, 40:14</p> <p><b>digits</b> [1] - 122:23</p> <p><b>diligence</b> [1] - 63:2</p> <p><b>diploma</b> [1] - 35:16</p> <p><b>diplomatic</b> [1] - 93:7</p> <p><b>direct</b> [12] - 9:12, 40:15, 87:20, 99:17, 169:19, 175:22, 188:1, 190:11, 202:23, 228:19, 229:1, 251:11</p> <p><b>directing</b> [1] - 208:15</p> <p><b>direction</b> [1] - 167:3</p> <p><b>directional</b> [5] - 165:14, 165:21, 166:1, 167:16, 193:21</p> <p><b>directionally</b> [1] - 217:15</p> <p><b>directions</b> [6] - 116:11, 119:3, 136:23, 168:23, 175:4, 196:9</p>
--	---	---	---	--

<p><b>directly</b> [22] - 39:3, 48:12, 69:18, 72:25, 149:13, 149:16, 160:7, 161:14, 161:19, 162:1, 162:4, 163:5, 202:12, 203:11, 203:19, 204:12, 212:16, 216:25, 227:2, 244:21, 251:13, 254:8</p> <p><b>Director</b> [6] - 53:2, 53:5, 74:13, 74:14, 216:1</p> <p><b>director</b> [1] - 54:17</p> <p><b>Directors</b> [1] - 108:24</p> <p><b>disabled</b> [1] - 177:21</p> <p><b>disadvantages</b> [1] - 233:4</p> <p><b>disappeared</b> [1] - 39:6</p> <p><b>disappears</b> [1] - 83:19</p> <p><b>discarded</b> [1] - 46:2</p> <p><b>disclaimer</b> [1] - 14:18</p> <p><b>disclose</b> [1] - 240:21</p> <p><b>disclosed</b> [16] - 145:3, 171:12, 171:13, 178:11, 193:14, 202:3, 203:4, 209:17, 213:3, 217:4, 228:14, 235:19, 247:16, 263:5, 264:7, 269:6</p> <p><b>disclosure</b> [3] - 19:5, 204:15, 269:7</p> <p><b>discovery</b> [1] - 74:11</p> <p><b>discovery-level</b> [1] - 74:11</p> <p><b>discuss</b> [6] - 79:3, 102:11, 114:14, 151:4, 234:11, 242:2</p> <p><b>discussed</b> [10] - 31:6, 40:10, 43:4, 109:4, 155:21, 170:1, 243:4, 249:6, 259:16, 261:24</p> <p><b>discusses</b> [1] - 183:22</p> <p><b>discussing</b> [4] - 83:2, 190:5, 214:17, 259:13</p> <p><b>discussion</b> [7] - 78:12, 91:22, 112:10, 154:4, 172:13, 216:6, 259:11</p> <p><b>Discussion</b> [1] - 13:17</p> <p><b>discussions</b> [3] - 14:25, 17:3, 256:5</p> <p><b>disentangle</b> [3] - 100:20, 120:24, 129:22</p>	<p><b>disk</b> [2] - 244:8, 244:9</p> <p><b>disks</b> [1] - 244:7</p> <p><b>display</b> [1] - 232:24</p> <p><b>disregarded</b> [1] - 84:9</p> <p><b>disseminated</b> [1] - 62:24</p> <p><b>dissemination</b> [1] - 21:1</p> <p><b>distinction</b> [3] - 38:2, 91:4, 94:10</p> <p><b>distinguish</b> [1] - 94:9</p> <p><b>distribute</b> [1] - 228:22</p> <p><b>distribute-shared-memory</b> [1] - 228:22</p> <p><b>distributed</b> [3] - 25:2, 171:16, 228:18</p> <p><b>distributing</b> [1] - 209:21</p> <p><b>doc</b> [3] - 24:18, 48:8, 182:20</p> <p><b>doctor</b> [2] - 21:5, 21:6</p> <p><b>Document</b> [5] - 3:10, 23:17, 96:9, 96:12, 96:18</p> <p><b>document</b> [95] - 11:4, 11:7, 13:7, 14:21, 21:1, 22:12, 37:11, 38:23, 39:8, 40:21, 41:7, 41:12, 41:18, 42:19, 47:1, 47:16, 47:17, 47:19, 51:12, 51:20, 52:24, 56:2, 57:12, 58:11, 58:14, 59:12, 60:22, 60:25, 61:16, 61:22, 62:5, 62:11, 65:13, 65:19, 66:18, 70:21, 72:18, 75:15, 76:3, 76:22, 77:3, 77:7, 78:6, 81:4, 81:16, 81:22, 83:6, 83:13, 83:17, 84:12, 84:15, 85:24, 86:13, 87:24, 88:7, 88:15, 88:23, 90:11, 96:21, 100:6, 100:13, 101:13, 102:14, 103:4, 103:9, 104:11, 104:25, 105:19, 106:2, 107:7, 109:21, 112:4, 126:16, 133:13, 133:15, 142:5, 142:9, 142:11, 144:16, 147:6, 148:10, 200:17, 200:24, 202:4, 203:5, 204:11, 204:15, 228:3, 234:10, 234:11,</p>	<p>238:10, 246:11, 249:12, 263:3</p> <p><b>documenting</b> [1] - 57:1</p> <p><b>documents</b> [25] - 5:23, 8:13, 12:6, 13:25, 14:13, 14:20, 15:1, 15:11, 16:18, 16:23, 43:22, 53:8, 61:19, 67:15, 69:16, 69:23, 73:2, 86:11, 89:19, 90:8, 109:16, 109:17, 109:25, 125:4, 185:23</p> <p><b>Dolphin</b> [5] - 40:8, 42:22, 42:24, 43:7, 97:9</p> <p><b>Dolphin's</b> [1] - 40:8</p> <p><b>domain</b> [4] - 92:12, 93:23, 95:9, 95:11</p> <p><b>done</b> [50] - 23:20, 23:23, 25:1, 27:24, 44:18, 46:7, 47:21, 50:4, 51:11, 54:1, 66:4, 68:12, 81:9, 87:20, 100:22, 134:20, 138:15, 168:10, 169:11, 175:25, 179:1, 179:2, 190:17, 209:18, 211:17, 212:9, 212:11, 217:9, 217:13, 218:5, 224:17, 236:5, 236:8, 236:16, 238:20, 245:25, 246:11, 247:4, 247:16, 263:4, 263:8, 263:9, 263:10, 263:20, 263:24, 264:12, 265:3, 266:1, 271:22, 271:24</p> <p><b>dotted</b> [1] - 128:25</p> <p><b>double</b> [1] - 127:6</p> <p><b>doubt</b> [4] - 68:2, 89:23, 100:6, 204:17</p> <p><b>down</b> [14] - 9:6, 30:25, 53:21, 116:3, 116:5, 132:8, 135:14, 154:19, 167:19, 216:22, 222:2, 223:3, 236:13, 275:9</p> <p><b>download</b> [1] - 85:7</p> <p><b>downloaded</b> [1] - 89:19</p> <p><b>Dr</b> [20] - 4:15, 4:17, 5:17, 18:23, 21:4, 21:7, 46:10, 66:1, 76:2, 77:18, 78:6,</p>	<p>92:3, 99:23, 105:14, 105:15, 106:17, 107:12, 170:3, 271:2</p> <p><b>draft</b> [3] - 15:13, 51:8, 51:10</p> <p><b>drafted</b> [1] - 14:20</p> <p><b>drained</b> [1] - 237:5</p> <p><b>drains</b> [1] - 231:24</p> <p><b>draw</b> [5] - 91:3, 91:7, 93:20, 94:10, 101:21</p> <p><b>drawing</b> [1] - 159:12</p> <p><b>drawn</b> [7] - 36:25, 93:25, 159:19, 199:22, 201:25, 253:24, 254:6</p> <p><b>drive</b> [3] - 132:2, 132:4, 160:24</p> <p><b>drivers</b> [5] - 186:12, 186:18, 187:11, 187:18, 191:10</p> <p><b>driving</b> [1] - 131:24</p> <p><b>drmüller.com</b> [1] - 91:17</p> <p><b>dual</b> [3] - 24:24, 134:10, 135:19</p> <p><b>duly</b> [2] - 4:1, 275:7</p> <p><b>Dunn</b> [2] - 1:20, 4:6</p> <p><b>DUNN</b> [1] - 2:4</p> <p><b>duplex</b> [2] - 165:21, 165:24</p> <p><b>during</b> [14] - 68:19, 113:16, 113:17, 114:3, 114:7, 114:23, 114:24, 126:10, 126:11, 126:24, 127:14, 127:15, 137:5, 137:6</p>	<p>181:8, 265:13</p> <p><b>efficiently</b> [1] - 216:13</p> <p><b>effort</b> [4] - 16:4, 40:2, 45:5, 84:7</p> <p><b>eight</b> [2] - 88:18, 88:21</p> <p><b>either</b> [8] - 12:24, 27:12, 44:13, 70:22, 109:4, 122:4, 244:17, 253:10</p> <p><b>electric</b> [1] - 25:24</p> <p><b>electrically</b> [1] - 132:4</p> <p><b>Electronic</b> [1] - 100:3</p> <p><b>electronic</b> [3] - 69:5, 71:16, 71:22</p> <p><b>electronically</b> [1] - 204:7</p> <p><b>element</b> [10] - 17:13, 30:11, 116:3, 140:11, 156:16, 156:17, 156:18, 161:24, 164:18</p> <p><b>elements</b> [9] - 83:5, 116:7, 118:14, 142:17, 156:13, 156:14, 169:2, 202:11, 255:19</p> <p><b>elsewhere</b> [1] - 31:11</p> <p><b>email</b> [3] - 12:1, 39:2, 51:4</p> <p><b>Email</b> [2] - 2:9, 2:18</p> <p><b>emails</b> [2] - 39:9, 47:7</p> <p><b>Embankment</b> [1] - 1:21</p> <p><b>embarrassment</b> [1] - 74:23</p> <p><b>embodiment</b> [1] - 181:17</p> <p><b>embodiments</b> [1] - 193:14</p> <p><b>EMC</b> [7] - 1:5, 4:7, 12:9, 12:24, 87:15, 99:7, 195:12</p> <p><b>emitter</b> [2] - 231:24</p> <p><b>emitter-coupled</b> [1] - 231:24</p> <p><b>emphasized</b> [1] - 214:21</p> <p><b>emphasizing</b> [1] - 26:20</p> <p><b>employed</b> [2] - 275:15, 275:16</p> <p><b>employee</b> [5] - 93:21, 94:20, 94:21, 94:23</p> <p><b>employee-employee</b> [1] - 93:21</p> <p><b>employees</b> [1] - 90:19</p> <p><b>employer</b> [2] - 92:19, 92:23</p> <p><b>employer's</b> [1] - 92:19</p> <p><b>enable</b> [10] - 13:9,</p>
--	---	--	---	---



<p>126:20, 129:19, 144:3, 146:11, 177:15, 210:7, 211:19, 216:7, 216:12</p> <p><b>enabled</b> [2] - 85:12, 252:24</p> <p><b>enables</b> [18] - 113:17, 114:6, 114:24, 122:4, 122:8, 122:13, 123:3, 123:12, 126:11, 127:15, 130:22, 132:14, 137:6, 141:7, 143:2, 145:4, 174:10, 248:3</p> <p><b>enabling</b> [3] - 143:5, 154:17, 189:7</p> <p><b>encapsulated</b> [1] - 83:13</p> <p><b>enclosure</b> [1] - 48:15</p> <p><b>encoded</b> [29] - 112:16, 119:2, 122:14, 136:21, 137:1, 137:2, 137:24, 138:22, 139:11, 140:4, 140:13, 140:25, 141:3, 141:8, 151:14, 155:21, 156:1, 166:17, 167:1, 168:25, 169:3, 175:3, 187:24, 196:8, 211:14, 245:14, 245:21, 259:12, 259:15</p> <p><b>encoder</b> [5] - 157:19, 233:7, 233:19, 238:14, 245:11</p> <p><b>encodes</b> [1] - 184:5</p> <p><b>encoding</b> [16] - 154:8, 156:10, 156:21, 158:16, 169:10, 169:16, 233:10, 233:13, 233:14, 233:16, 233:23, 234:2, 234:11, 234:12</p> <p><b>encountered</b> [1] - 170:3</p> <p><b>end</b> [27] - 72:24, 79:1, 80:16, 84:10, 143:18, 144:3, 149:23, 154:25, 169:12, 169:17, 176:15, 177:17, 191:1, 191:13, 191:15, 196:3, 212:17, 219:6, 220:14, 224:17,</p>	<p>242:1, 243:8, 243:22, 249:20, 250:9, 262:10, 270:1</p> <p><b>ended</b> [1] - 262:9</p> <p><b>endowed</b> [1] - 27:6</p> <p><b>ends</b> [1] - 72:14</p> <p><b>energy</b> [1] - 43:17</p> <p><b>engaged</b> [2] - 11:19, 13:9</p> <p><b>engagement</b> [2] - 12:22, 16:4</p> <p><b>engine</b> [1] - 80:18</p> <p><b>engineer</b> [1] - 269:4</p> <p><b>engineered</b> [1] - 31:25</p> <p><b>engineering</b> [10] - 28:3, 28:4, 29:9, 30:4, 30:8, 30:20, 44:5, 48:13, 55:18</p> <p><b>engineering/ computer</b> [1] - 27:21</p> <p><b>engines</b> [2] - 80:14, 80:20</p> <p><b>English</b> [1] - 45:25</p> <p><b>ensure</b> [1] - 186:13</p> <p><b>enter</b> [2] - 61:13, 91:21</p> <p><b>entering</b> [1] - 61:6</p> <p><b>entire</b> [21] - 10:7, 33:6, 45:5, 81:21, 87:24, 97:11, 106:23, 149:14, 157:10, 167:5, 177:23, 179:4, 203:17, 210:3, 220:13, 224:7, 224:14, 241:18, 241:22, 248:25, 256:11</p> <p><b>entirely</b> [4] - 11:8, 12:18, 93:1, 189:14</p> <p><b>entirety</b> [1] - 261:14</p> <p><b>entitled</b> [1] - 3:10</p> <p><b>entry</b> [2] - 61:3</p> <p><b>environmental</b> [1] - 130:12</p> <p><b>envision</b> [1] - 211:6</p> <p><b>EP</b> [2] - 100:3, 100:8</p> <p><b>Equipment</b> [1] - 40:12</p> <p><b>equipment</b> [1] - 92:18</p> <p><b>equivalent</b> [1] - 29:24</p> <p><b>Error</b> [1] - 222:22</p> <p><b>error</b> [7] - 33:16, 88:14, 222:21, 222:23, 222:25, 229:9, 261:11</p> <p><b>errors</b> [2] - 18:5, 222:24</p> <p><b>escalated</b> [1] - 74:5</p> <p><b>ESQ</b> [2] - 2:7, 2:16</p> <p><b>essential</b> [2] - 57:5, 134:19</p>	<p><b>establish</b> [2] - 107:10, 147:11</p> <p><b>established</b> [1] - 232:3</p> <p><b>estimates</b> [1] - 17:24</p> <p><b>et</b> [5] - 146:4, 167:22, 169:5</p> <p><b>Ethernet</b> [2] - 203:23, 204:1</p> <p><b>European</b> [1] - 84:17</p> <p><b>euros</b> [1] - 91:8</p> <p><b>evaluate</b> [3] - 49:7, 52:17, 260:9</p> <p><b>evaluated</b> [1] - 40:10</p> <p><b>evaluation</b> [1] - 45:24</p> <p><b>evaluations</b> [1] - 50:4</p> <p><b>eventually</b> [1] - 72:24</p> <p><b>everything</b> [1] - 68:3</p> <p><b>evidence</b> [4] - 58:12, 59:13, 99:21, 104:17</p> <p><b>evidentiary</b> [2] - 99:16, 105:8</p> <p><b>evoked</b> [1] - 84:21</p> <p><b>evolved</b> [2] - 34:22, 182:8</p> <p><b>exact</b> [15] - 11:24, 13:20, 16:6, 16:9, 21:14, 34:19, 55:11, 56:8, 56:14, 67:10, 97:8, 174:24, 182:13, 247:12, 256:8</p> <p><b>exactly</b> [11] - 25:17, 43:25, 50:18, 125:11, 153:19, 179:8, 192:7, 224:21, 237:23, 255:5, 272:8</p> <p><b>Examination</b> [1] - 3:3</p> <p><b>EXAMINATION</b> [1] - 4:13</p> <p><b>examination</b> [1] - 6:23</p> <p><b>examined</b> [1] - 4:2</p> <p><b>example</b> [76] - 8:11, 8:19, 8:20, 15:19, 18:24, 28:21, 30:7, 30:8, 31:22, 33:2, 49:6, 50:2, 50:5, 54:1, 55:21, 69:1, 71:12, 74:4, 76:11, 83:10, 84:8, 93:3, 98:19, 98:23, 99:3, 115:2, 127:24, 128:2, 128:3, 133:22, 142:7, 144:17, 146:2, 146:10, 146:19, 154:14, 156:22, 156:25, 157:5, 159:19, 160:4,</p>	<p>160:5, 160:6, 165:6, 165:15, 179:15, 181:16, 183:3, 187:16, 191:8, 192:23, 199:10, 203:21, 205:7, 206:13, 209:3, 210:20, 211:7, 217:12, 219:5, 221:14, 222:13, 224:9, 225:13, 226:12, 227:4, 231:3, 235:20, 240:22, 244:7, 248:11, 250:23, 264:9, 264:13, 264:17, 272:4</p> <p><b>examples</b> [6] - 126:14, 158:10, 179:10, 183:25, 184:12, 205:4</p> <p><b>exams</b> [1] - 25:7</p> <p><b>exceed</b> [1] - 130:13</p> <p><b>except</b> [11] - 15:9, 32:2, 33:1, 49:21, 75:19, 98:1, 131:5, 193:22, 202:5, 212:11, 242:1</p> <p><b>exception</b> [1] - 274:5</p> <p><b>exceptional</b> [1] - 261:8</p> <p><b>exchanged</b> [3] - 130:17, 131:1, 168:9</p> <p><b>exciting</b> [1] - 272:2</p> <p><b>exclude</b> [1] - 173:17</p> <p><b>excluded</b> [1] - 173:25</p> <p><b>excludes</b> [1] - 188:16</p> <p><b>excuse</b> [4] - 67:24, 82:2, 143:8, 162:15</p> <p><b>execute</b> [6] - 190:13, 251:16, 257:20, 257:22, 258:8, 258:10</p> <p><b>executed</b> [11] - 120:19, 146:13, 212:13, 212:14, 212:16, 251:16, 257:6, 258:20, 259:5, 259:21, 260:13</p> <p><b>executes</b> [1] - 210:24</p> <p><b>execution</b> [1] - 261:15</p> <p><b>exercising</b> [1] - 63:2</p> <p><b>Exhibit</b> [14] - 13:24, 37:6, 51:7, 58:1, 75:13, 85:21, 86:18, 87:16, 89:1, 99:7, 103:21, 124:14, 125:21, 157:22</p> <p><b>exhibit</b> [4] - 3:9, 24:3,</p>	<p>115:25, 142:11</p> <p><b>exhibits</b> [1] - 115:24</p> <p><b>exist</b> [12] - 26:2, 43:2, 44:3, 83:3, 143:16, 157:9, 182:22, 190:15, 229:11, 232:22, 255:4, 255:8</p> <p><b>existed</b> [3] - 33:12, 43:8, 80:20</p> <p><b>existence</b> [2] - 9:17, 143:6</p> <p><b>existing</b> [4] - 32:14, 45:7, 129:23, 187:19</p> <p><b>exists</b> [1] - 39:13</p> <p><b>expanded</b> [1] - 238:15</p> <p><b>expect</b> [5] - 184:19, 225:4, 248:8, 249:7, 249:12</p> <p><b>expected</b> [2] - 67:5, 136:15</p> <p><b>expecting</b> [1] - 250:18</p> <p><b>expensive</b> [7] - 49:2, 71:23, 72:7, 79:16, 85:14, 253:2, 271:10</p> <p><b>experience</b> [8] - 25:23, 31:3, 34:3, 36:8, 54:18, 98:11, 101:22, 106:11</p> <p><b>experiment</b> [20] - 42:6, 43:19, 44:15, 44:21, 45:4, 45:13, 55:5, 55:6, 70:6, 74:17, 91:12, 93:3, 101:8, 101:12, 101:13, 101:23, 102:2, 106:22, 106:25, 107:6</p> <p><b>experimental</b> [1] - 25:8</p> <p><b>experiments</b> [9] - 26:4, 45:2, 46:18, 73:15, 73:17, 100:18, 100:21, 100:22, 100:23</p> <p><b>expert</b> [12] - 11:12, 11:16, 26:21, 32:15, 35:23, 36:5, 36:24, 109:6, 204:15, 209:4, 216:4, 217:10</p> <p><b>expert's</b> [1] - 36:21</p> <p><b>expertise</b> [1] - 67:12</p> <p><b>experts</b> [1] - 13:9</p> <p><b>explain</b> [4] - 7:10, 28:21, 75:7, 159:5</p> <p><b>explained</b> [1] - 121:3</p> <p><b>explains</b> [1] - 28:25</p> <p><b>explanation</b> [5] - 35:3, 52:4, 123:18, 132:16, 176:3</p> <p><b>explicit</b> [3] - 75:18,</p>
--	---	--	---	---

<p>159:4, 188:22  <b>explicitly</b> [18] - 51:9,  66:5, 77:1, 121:13,  122:5, 122:21,  138:9, 138:12,  142:21, 158:17,  187:23, 188:2,  212:23, 238:11,  257:1, 257:11,  258:19, 258:25  <b>exposed</b> [1] - 227:24  <b>expressly</b> [2] - 121:20,  122:3  <b>extending</b> [3] -  112:16, 116:12,  167:24  <b>extension</b> [1] - 82:12  <b>extent</b> [2] - 62:25,  236:5  <b>external</b> [1] - 134:24  <b>extract</b> [1] - 238:22  <b>extrapolate</b> [1] - 49:7  <b>extreme</b> [2] - 251:14,  268:9  <b>extremely</b> [6] - 101:4,  101:5, 197:2,  231:20, 253:2,  265:22</p>	<p><b>familiar</b> [6] - 37:11,  96:1, 182:2, 185:22,  192:2, 215:2  <b>family</b> [3] - 22:16,  29:11, 31:22  <b>famous</b> [1] - 156:22  <b>fancier</b> [1] - 253:11  <b>far</b> [21] - 9:23, 12:6,  34:11, 57:5, 59:12,  60:25, 102:8,  169:17, 191:1,  213:1, 213:5,  220:14, 232:25,  242:1, 243:8,  249:20, 262:10,  263:6, 263:19,  265:4, 270:1  <b>fast</b> [6] - 30:19, 181:8,  184:8, 201:9,  231:19, 251:10  <b>faster</b> [4] - 44:6, 75:2,  229:22, 235:23  <b>fastest</b> [2] - 232:25  <b>fault</b> [2] - 20:17,  266:15  <b>favor</b> [1] - 57:14  <b>features</b> [2] - 120:21,  149:11  <b>Federal</b> [1] - 22:5  <b>Fellowship</b> [2] -  24:19, 24:23  <b>felt</b> [1] - 171:21  <b>few</b> [14] - 15:10, 17:3,  30:3, 32:18, 33:1,  52:11, 76:6, 82:21,  109:14, 127:5,  127:17, 134:3,  148:7, 177:23  <b>fibre</b> [2] - 45:25, 46:3  <b>FIBRE</b> [1] - 45:25  <b>field</b> [26] - 26:11, 28:6,  29:25, 30:1, 30:9,  31:3, 33:22, 34:3,  35:23, 39:7, 43:17,  47:8, 51:12, 54:19,  65:2, 109:6, 130:6,  209:4, 216:1, 226:6,  244:22, 247:11,  267:19, 268:23  <b>fields</b> [3] - 29:8, 38:6,  225:18  <b>fifteen</b> [1] - 17:25  <b>fight</b> [1] - 8:16  <b>Figure</b> [92] - 49:11,  49:13, 50:5, 50:8,  128:7, 131:7,  144:15, 144:20,  144:21, 152:5,  152:6, 152:23,  160:1, 180:2, 184:7,</p>	<p>192:16, 192:19,  192:22, 195:10,  196:12, 197:7,  197:15, 197:17,  197:20, 198:7,  199:10, 199:14,  199:15, 199:17,  199:22, 200:4,  200:9, 200:10,  200:18, 200:19,  200:22, 201:14,  201:15, 201:24,  202:6, 202:12,  202:13, 203:8,  203:9, 204:12,  204:21, 204:23,  204:25, 205:2,  205:5, 205:9, 206:1,  206:2, 206:9,  206:10, 206:18,  207:6, 207:11,  209:7, 210:12,  210:13, 211:22,  212:3, 213:16,  215:10, 216:11,  217:22, 221:2,  222:9, 223:19,  228:12, 230:25,  231:4, 231:5,  234:18, 235:11,  239:1, 239:3,  242:18, 242:20,  243:5, 243:16,  244:10, 245:11,  250:21, 254:2,  254:7, 268:16  <b>figure</b> [10] - 44:13,  130:2, 152:20,  160:11, 193:14,  233:6, 251:1, 251:2,  251:4, 253:17  <b>Figures</b> [5] - 151:16,  152:2, 153:5,  179:12, 179:24  <b>figures</b> [8] - 41:2,  41:13, 151:5, 151:6,  151:9, 151:18,  151:20, 251:4  <b>file</b> [17] - 22:22, 23:3,  41:9, 81:21, 82:3,  82:13, 82:23, 82:24,  83:1, 84:3, 84:22,  85:1, 85:11, 88:10,  88:19, 110:1, 110:10  <b>filed</b> [5] - 19:13, 23:24,  98:24, 99:4, 235:5  <b>files</b> [8] - 85:4, 86:20,  88:9, 88:11, 88:24,  89:12, 89:15, 90:3  <b>filing</b> [2] - 59:23, 110:9</p>	<p><b>fill</b> [5] - 45:5, 226:6,  246:16, 247:10,  267:18  <b>filled</b> [2] - 88:8, 245:7  <b>final</b> [6] - 19:23, 41:8,  67:2, 90:10, 174:18,  224:16  <b>finalized</b> [2] - 58:17,  69:22  <b>finally</b> [2] - 136:11,  240:12  <b>financed</b> [1] - 35:12  <b>financial</b> [1] - 97:8  <b>fine</b> [10] - 13:23,  16:11, 17:24, 71:5,  84:3, 128:16, 142:2,  151:7, 166:7, 192:15  <b>finish</b> [3] - 7:20, 7:21,  236:25  <b>finished</b> [2] - 7:6, 48:4  <b>FireWire</b> [4] - 181:21,  182:10, 183:24,  185:22  <b>firm</b> [1] - 92:13  <b>firm's</b> [1] - 92:16  <b>first</b> [42] - 15:4, 35:4,  35:18, 37:16, 38:4,  43:21, 43:22, 46:12,  50:20, 61:7, 70:7,  79:16, 84:9, 101:21,  103:4, 106:3,  107:15, 118:24,  124:1, 128:8, 129:4,  129:11, 131:24,  134:20, 134:22,  138:19, 143:14,  156:11, 156:15,  170:7, 182:18,  182:21, 196:5,  197:4, 207:18,  208:11, 208:23,  209:12, 210:2,  210:12, 217:2  <b>fit</b> [2] - 50:1, 233:14  <b>five</b> [7] - 55:12, 73:24,  144:12, 144:13,  150:14, 180:11,  180:12  <b>five-wire</b> [1] - 180:11  <b>fixed</b> [2] - 247:5, 265:9  <b>fixed-length</b> [1] -  247:5  <b>flat</b> [3] - 79:15, 184:16,  184:25  <b>flavors</b> [2] - 130:20,  249:1  <b>flexibility</b> [1] - 201:20  <b>flight</b> [3] - 40:1,  214:12, 232:4  <b>flip</b> [1] - 161:23</p>	<p><b>flow</b> [12] - 129:16,  131:6, 143:4,  146:14, 217:14,  221:21, 222:3,  222:5, 230:6, 235:9,  236:11, 255:4  <b>flush</b> [1] - 252:25  <b>flushing</b> [1] - 253:1  <b>focus</b> [3] - 29:5, 41:16,  45:8  <b>focused</b> [2] - 46:3,  49:12  <b>focusing</b> [2] - 73:25,  106:9  <b>follow</b> [3] - 75:8, 81:8,  272:3  <b>follow-up</b> [1] - 75:8  <b>followed</b> [2] - 125:10,  131:8  <b>following</b> [3] - 53:13,  246:1, 252:8  <b>follows</b> [1] - 4:2  <b>footer</b> [1] - 86:21  <b>FOR</b> [2] - 2:3, 2:11  <b>forbid</b> [1] - 70:19  <b>force</b> [2] - 25:24,  160:25  <b>forces</b> [2] - 25:22,  46:8  <b>foregoing</b> [1] - 274:3  <b>foreigner</b> [1] - 50:20  <b>forget</b> [2] - 209:6,  247:8  <b>form</b> [196] - 23:4,  26:19, 32:10, 34:1,  39:10, 41:14, 49:17,  49:21, 49:22, 49:25,  58:8, 59:4, 59:19,  62:8, 63:20, 64:6,  64:19, 66:13, 67:22,  68:1, 71:6, 73:7,  75:17, 77:5, 81:23,  82:5, 83:6, 85:5,  86:6, 86:14, 86:24,  87:7, 87:18, 89:3,  89:17, 91:1, 91:19,  92:5, 92:21, 94:12,  95:10, 96:16, 96:19,  97:4, 97:19, 98:12,  101:17, 102:24,  103:22, 104:13,  105:7, 105:18,  110:22, 111:2,  116:15, 116:22,  117:7, 117:23,  118:22, 119:16,  119:20, 120:1,  120:6, 121:9,  121:12, 121:23,  122:10, 122:14,</p>
<p style="text-align: center;"><b>F</b></p>				
<p><b>facilitate</b> [1] - 153:7  <b>facing</b> [1] - 250:22  <b>fact</b> [28] - 11:11,  32:20, 35:18, 37:13,  51:12, 54:20, 72:2,  81:13, 88:18, 93:11,  146:15, 147:22,  159:18, 165:19,  182:18, 187:13,  188:6, 196:16,  201:15, 203:7,  234:13, 236:6,  238:11, 238:13,  239:7, 265:12,  271:9, 271:25  <b>facto</b> [1] - 126:17  <b>factor</b> [5] - 49:17,  49:21, 49:22, 49:25,  63:12  <b>facts</b> [3] - 11:12,  20:19, 95:8  <b>fail</b> [1] - 261:9  <b>failed</b> [1] - 75:4  <b>fair</b> [8] - 7:13, 20:6,  24:6, 28:24, 184:23,  185:1, 254:19,  261:12  <b>fairly</b> [1] - 151:6  <b>fall</b> [1] - 158:10</p>				

<p>123:4, 123:25, 137:8, 137:21, 139:5, 141:4, 141:9, 145:22, 146:25, 147:4, 147:6, 147:10, 147:17, 147:19, 147:20, 148:2, 148:3, 149:8, 149:15, 150:1, 150:10, 150:18, 151:14, 152:24, 153:1, 153:8, 154:3, 155:4, 155:12, 158:16, 162:13, 162:24, 164:17, 164:19, 164:25, 166:23, 168:1, 168:11, 173:18, 174:22, 175:6, 175:15, 175:18, 176:8, 179:11, 179:13, 180:21, 181:20, 181:22, 182:5, 185:6, 187:21, 190:3, 191:16, 194:7, 194:9, 195:14, 197:16, 197:24, 198:21, 198:24, 199:19, 200:12, 201:2, 202:19, 203:13, 204:13, 207:4, 213:21, 215:8, 215:22, 218:3, 218:20, 218:25, 223:13, 226:3, 226:10, 230:14, 231:12, 231:14, 233:9, 233:13, 234:21, 235:16, 238:9, 239:15, 239:24, 240:9, 240:25, 241:1, 241:6, 241:20, 243:2, 244:23, 245:9, 245:23, 246:14, 246:20, 247:8, 247:14, 247:23, 248:7, 250:17, 250:19, 253:23, 254:17, 254:22, 255:21, 256:4, 256:24, 257:18, 257:24, 258:4, 258:12, 258:22, 259:8, 259:24, 260:7, 260:24, 261:17, 262:25, 264:2, 267:25, 268:20, 268:24,</p>	<p>269:2, 269:15, 270:12 <b>form</b>" [2] - 117:2, 140:6 <b>format</b> [9] - 82:24, 83:21, 84:17, 84:19, 147:8, 149:18, 149:22, 149:25, 222:10 <b>forms</b> [2] - 181:15, 189:6 <b>forth</b> [46] - 6:22, 7:10, 8:13, 15:10, 21:24, 22:1, 36:10, 36:11, 39:18, 39:22, 40:11, 44:24, 47:11, 49:17, 66:25, 69:9, 70:16, 71:19, 72:1, 72:16, 73:1, 74:7, 80:8, 101:14, 109:15, 112:10, 114:18, 115:5, 115:7, 120:15, 131:1, 145:19, 160:17, 180:17, 185:11, 185:14, 203:18, 217:14, 233:15, 234:3, 234:23, 236:13, 238:24, 248:15, 250:9, 275:5 <b>fortunately</b> [2] - 9:24, 53:20 <b>forward</b> [1] - 219:11 <b>four</b> [14] - 17:15, 17:16, 17:23, 25:23, 31:2, 33:21, 44:8, 55:12, 100:18, 100:22, 180:9, 222:16, 223:1, 223:9 <b>four-byte</b> [1] - 223:9 <b>fraction</b> [3] - 41:23, 81:19, 201:5 <b>fragments</b> [1] - 88:14 <b>FRAME</b> [1] - 153:9 <b>frame</b> [13] - 66:15, 128:9, 129:2, 143:7, 143:8, 143:9, 143:22, 143:25, 144:2, 144:8, 145:1, 145:19 <b>FrameMaker</b> [2] - 39:12, 39:15 <b>framework</b> [3] - 49:6, 74:3, 96:23 <b>Frankfurt</b> [5] - 4:18, 4:22, 4:24, 24:13, 25:13 <b>freedom</b> [1] - 70:3 <b>French</b> [1] - 157:9 <b>frequent</b> [1] - 39:21</p>	<p><b>frequently</b> [1] - 50:17 <b>front</b> [9] - 37:21, 38:22, 53:4, 57:25, 73:21, 160:8, 194:15, 219:7, 219:23 <b>full</b> [16] - 4:16, 4:19, 10:14, 14:17, 27:6, 34:10, 54:17, 88:8, 147:24, 165:21, 165:24, 237:10, 265:20, 275:13 <b>fully</b> [1] - 43:2 <b>function</b> [4] - 115:8, 124:5, 134:6, 230:2 <b>functionalities</b> [2] - 149:10, 248:11 <b>functionality</b> [29] - 80:2, 80:7, 120:14, 121:17, 128:6, 129:24, 146:13, 160:6, 171:8, 190:10, 190:21, 203:4, 212:15, 212:19, 212:22, 219:8, 219:10, 229:7, 238:16, 239:2, 239:7, 249:3, 251:23, 251:25, 252:7, 253:3, 255:10, 256:19, 259:14 <b>functioning</b> [2] - 170:21, 263:21 <b>functions</b> [1] - 145:15 <b>fundamental</b> [13] - 25:20, 25:22, 26:2, 30:9, 41:21, 101:2, 143:11, 158:11, 171:1, 177:6, 208:2, 223:17, 256:17 <b>funding</b> [1] - 93:17 <b>funds</b> [1] - 97:14 <b>funny</b> [2] - 8:23, 229:12 <b>fusion</b> [2] - 74:19, 74:22 <b>future</b> [2] - 57:3, 272:18</p>	<p><b>geeks</b> [1] - 33:1 <b>Gene</b> [2] - 31:22, 229:11 <b>general</b> [7] - 54:14, 66:14, 106:20, 159:13, 164:9, 268:11, 269:22 <b>generally</b> [1] - 182:4 <b>Generate</b> [1] - 221:9 <b>generate</b> [6] - 85:2, 180:7, 189:1, 195:5, 199:6, 219:23 <b>generated</b> [7] - 41:9, 59:11, 211:15, 212:4, 230:17, 237:15, 244:13 <b>generates</b> [1] - 194:20 <b>generating</b> [1] - 209:8 <b>generation</b> [1] - 193:23 <b>generations</b> [1] - 44:9 <b>generic</b> [10] - 33:10, 34:2, 90:14, 106:23, 158:16, 183:2, 186:22, 193:12, 212:12, 256:12 <b>Geneva</b> [2] - 40:1, 40:14 <b>geographic</b> [1] - 178:2 <b>German</b> [3] - 5:10, 91:10, 166:5 <b>Germany</b> [9] - 7:3, 9:14, 10:5, 10:18, 10:25, 74:20, 78:4, 91:9, 157:8 <b>Gibson</b> [2] - 1:20, 4:6 <b>GIBSON</b> [1] - 2:4 <b>gigabyte</b> [1] - 135:24 <b>gigabytes</b> [3] - 223:25, 227:19, 227:21 <b>given</b> [15] - 6:8, 8:8, 10:2, 59:8, 94:1, 98:19, 105:19, 107:17, 153:12, 185:11, 198:25, 209:17, 222:4, 249:22 <b>globe</b> [1] - 54:24 <b>Goethe</b> [1] - 25:19 <b>Google</b> [1] - 80:20 <b>Googled</b> [1] - 77:10 <b>government</b> [2] - 9:19, 91:9 <b>grab</b> [1] - 229:7 <b>graduated</b> [1] - 24:16 <b>grain</b> [1] - 99:6 <b>granted</b> [1] - 236:23 <b>granularity</b> [1] - 264:4 <b>graphics</b> [4] - 83:7,</p>	<p>160:10, 160:12, 232:24 <b>gravitation</b> [1] - 25:24 <b>great</b> [4] - 39:17, 141:20, 150:3, 186:9 <b>green</b> [2] - 50:22, 50:24 <b>grey</b> [3] - 69:24, 207:12, 212:3 <b>grinding</b> [1] - 271:9 <b>Group</b> [2] - 100:4, 100:8 <b>group</b> [32] - 38:7, 38:13, 40:5, 42:5, 46:7, 46:25, 47:2, 48:10, 54:9, 55:14, 57:1, 97:12, 100:8, 100:9, 102:1, 104:5, 104:6, 104:7, 104:9, 104:12, 105:3, 105:4, 105:5, 105:6, 105:16, 105:20, 105:25, 106:7, 106:9, 106:11, 106:12, 182:20 <b>groups</b> [3] - 52:19, 106:19, 107:2 <b>GSI</b> [2] - 5:3, 46:17 <b>guess</b> [9] - 46:21, 52:3, 78:13, 106:13, 172:11, 214:20, 230:12, 231:9, 232:15 <b>guesses</b> [1] - 106:13 <b>guest</b> [2] - 61:7, 92:9 <b>Gustafson</b> [1] - 46:21</p>
<b>H</b>				
<p><b>H-1</b> [1] - 50:22 <b>hacker</b> [1] - 81:1 <b>half</b> [1] - 70:11 <b>hand</b> [5] - 142:18, 157:20, 182:17, 185:15, 275:20 <b>handed</b> [1] - 37:5 <b>handful</b> [2] - 55:12, 106:12 <b>handle</b> [3] - 45:22, 145:13, 208:10 <b>handy</b> [1] - 181:24 <b>hanging</b> [1] - 197:14 <b>Hans</b> [19] - 20:23, 38:14, 39:3, 39:11, 40:15, 41:4, 41:6, 79:13, 80:10, 90:6, 94:21, 97:13, 97:20, 97:21, 97:25, 100:1, 102:20, 104:1 <b>happy</b> [2] - 35:2, 242:2</p>				

<p><b>hard</b> [4] - 16:18, 48:13, 160:24, 260:18</p> <p><b>hard-core</b> [1] - 48:13</p> <p><b>hardly</b> [2] - 14:23, 226:15</p> <p><b>hardware</b> [17] - 177:18, 188:7, 188:12, 188:17, 189:1, 189:9, 189:20, 189:21, 189:22, 190:2, 191:12, 191:21, 191:23, 193:17, 194:4, 194:5, 194:11</p> <p><b>hash</b> [1] - 222:20</p> <p><b>HCCC</b> [1] - 67:21</p> <p><b>HDL</b> [1] - 48:14</p> <p><b>head</b> [9] - 4:25, 5:20, 19:11, 40:12, 135:6, 141:19, 143:14, 148:12, 184:18</p> <p><b>header</b> [7] - 88:19, 100:12, 100:14, 222:16, 223:8, 226:7, 241:4</p> <p><b>heading</b> [2] - 56:3, 223:3</p> <p><b>heads</b> [1] - 34:12</p> <p><b>heard</b> [2] - 12:16, 271:13</p> <p><b>hearsay</b> [1] - 99:19</p> <p><b>Heavy</b> [2] - 45:13, 45:17</p> <p><b>Heidelberg</b> [2] - 10:6, 84:6</p> <p><b>height</b> [2] - 214:12, 232:4</p> <p><b>held</b> [1] - 13:17</p> <p><b>Helmholtz</b> [2] - 5:4</p> <p><b>help</b> [3] - 20:20, 47:17, 268:1</p> <p><b>helped</b> [1] - 15:17</p> <p><b>helpful</b> [2] - 25:10, 184:3</p> <p><b>helping</b> [2] - 47:15, 107:3</p> <p><b>helps</b> [1] - 223:20</p> <p><b>Hennessy</b> [1] - 264:11</p> <p><b>herby</b> [1] - 275:4</p> <p><b>hereby</b> [1] - 274:2</p> <p><b>hereinbefore</b> [1] - 275:5</p> <p><b>hereto</b> [1] - 275:11</p> <p><b>hereunto</b> [1] - 275:19</p> <p><b>hesitant</b> [2] - 164:7, 240:11</p> <p><b>hesitated</b> [1] - 32:16</p> <p><b>hexadecimal</b> [1] - 156:25</p>	<p><b>HIC</b> [2] - 192:1, 192:10</p> <p><b>hierarchical</b> [2] - 264:3, 269:4</p> <p><b>high</b> [24] - 9:19, 23:21, 25:17, 29:18, 32:24, 43:17, 47:8, 61:9, 61:15, 71:9, 74:24, 143:25, 175:11, 183:10, 195:25, 196:1, 199:2, 202:6, 213:5, 213:23, 216:3, 238:6, 238:17, 251:3</p> <p><b>high-energy</b> [1] - 43:17</p> <p><b>high-level</b> [6] - 23:21, 195:25, 199:2, 202:6, 213:5, 213:23</p> <p><b>high-speed</b> [1] - 183:10</p> <p><b>high-tech</b> [1] - 47:8</p> <p><b>higher</b> [3] - 127:22, 149:3, 248:15</p> <p><b>highly</b> [24] - 27:19, 35:18, 44:25, 47:7, 53:11, 54:19, 55:20, 68:13, 69:18, 71:24, 74:9, 92:25, 135:1, 171:9, 190:22, 201:22, 209:19, 213:8, 215:23, 216:20, 256:6, 261:5, 272:2, 272:12</p> <p><b>hinder</b> [1] - 171:11</p> <p><b>hint</b> [1] - 212:5</p> <p><b>histories</b> [2] - 22:22, 23:3</p> <p><b>history</b> [3] - 65:1, 110:1, 110:10</p> <p><b>hit</b> [1] - 253:9</p> <p><b>hoax</b> [1] - 74:23</p> <p><b>Hoch</b> [1] - 5:9</p> <p><b>HOCH</b> [1] - 5:9</p> <p><b>hold</b> [2] - 29:23, 74:14</p> <p><b>holds</b> [1] - 162:18</p> <p><b>home</b> [2] - 5:8, 103:24</p> <p><b>honest</b> [1] - 234:5</p> <p><b>honestly</b> [1] - 202:20</p> <p><b>hop</b> [1] - 230:12</p> <p><b>hopelessly</b> [1] - 44:14</p> <p><b>hoping</b> [1] - 172:15</p> <p><b>Horst</b> [19] - 169:24, 170:2, 171:3, 172:18, 172:20, 172:23, 173:6, 178:22, 195:10, 216:1, 219:12, 223:15, 228:15, 240:21, 241:21, 262:4, 263:4, 264:8,</p>	<p>271:2</p> <p><b>Horst/TNet</b> [2] - 194:14, 194:16</p> <p><b>host</b> [8] - 191:25, 192:23, 193:15, 211:15, 226:18, 226:23, 227:1, 261:7</p> <p><b>hour</b> [3] - 16:1, 25:7, 40:1</p> <p><b>hourly</b> [1] - 15:23</p> <p><b>hours</b> [4] - 16:3, 16:7, 17:21, 84:1</p> <p><b>hours'</b> [1] - 39:20</p> <p><b>House</b> [1] - 1:20</p> <p><b>house</b> [3] - 10:13, 11:2, 70:22</p> <p><b>HTML</b> [2] - 86:20, 86:22</p> <p><b>HTTP</b> [2] - 79:25, 82:9</p> <p><b>http://sunshine.cern.ch</b> [1] - 102:16</p> <p><b>huge</b> [10] - 45:5, 53:10, 53:25, 54:21, 61:19, 69:7, 74:21, 106:16, 227:23, 266:3</p> <p><b>Hugo</b> [1] - 40:7</p> <p><b>Humboldt</b> [2] - 24:18, 24:22</p> <p><b>hundreds</b> [1] - 224:4</p> <p><b>hungry</b> [2] - 231:20, 233:3</p> <p><b>hybrid</b> [1] - 136:4</p> <p><b>hypothetical</b> [2] - 256:1, 256:7</p>	<p><b>identify</b> [5] - 80:2, 217:1, 223:10, 224:25, 225:8</p> <p><b>identifying</b> [2] - 60:21, 225:11</p> <p><b>IDs</b> [1] - 209:16</p> <p><b>IEEE</b> [13] - 180:20, 181:17, 181:21, 182:17, 183:23, 184:15, 184:25, 185:3, 185:18, 232:3, 271:5, 271:7, 271:12</p> <p><b>ignore</b> [1] - 9:16</p> <p><b>II</b> [4] - 1:17, 23:16, 24:6, 273:4</p> <p><b>illegal</b> [1] - 145:6</p> <p><b>image</b> [1] - 27:18</p> <p><b>imagine</b> [3] - 72:13, 164:21, 229:9</p> <p><b>immediately</b> [6] - 72:15, 96:8, 131:8, 131:13, 146:15, 164:7</p> <p><b>immunity</b> [1] - 93:7</p> <p><b>impact</b> [1] - 71:10</p> <p><b>impair</b> [1] - 8:4</p> <p><b>implement</b> [3] - 191:11, 212:10, 269:18</p> <p><b>implementation</b> [3] - 3:10, 264:7, 267:6</p> <p><b>Implementation</b> [1] - 160:2</p> <p><b>implemented</b> [2] - 187:8, 246:10</p> <p><b>implements</b> [1] - 236:3</p> <p><b>implicit</b> [1] - 238:3</p> <p><b>implicitly</b> [9] - 164:12, 188:24, 203:20, 257:9, 257:13, 257:16, 258:24, 259:21</p> <p><b>important</b> [12] - 7:19, 23:24, 39:15, 71:11, 101:1, 113:13, 129:23, 154:12, 172:11, 174:9, 249:25, 253:17</p> <p><b>impose</b> [1] - 171:13</p> <p><b>imposed</b> [1] - 191:9</p> <p><b>improper</b> [2] - 99:20, 104:16</p> <p><b>improved</b> [1] - 35:5</p> <p><b>improvement</b> [2] - 232:19, 232:21</p> <p><b>IN</b> [1] - 275:19</p> <p><b>in-depth</b> [5] - 32:15, 33:14, 33:23, 68:12,</p>	<p>89:4</p> <p><b>inadvertently</b> [2] - 78:23, 79:10</p> <p><b>inappropriate</b> [1] - 68:14</p> <p><b>incarnation</b> [3] - 182:18, 184:14, 233:15</p> <p><b>incarnations</b> [1] - 50:12</p> <p><b>include</b> [12] - 23:23, 31:6, 113:15, 114:20, 126:9, 132:12, 132:13, 138:1, 138:18, 153:8, 154:6, 164:5</p> <p><b>included</b> [8] - 138:9, 138:12, 151:25, 257:10, 257:11, 257:13, 258:25, 263:16</p> <p><b>includes</b> [4] - 32:21, 114:1, 137:3, 137:4</p> <p><b>including</b> [4] - 141:6, 141:7, 169:4, 215:15</p> <p><b>incompatible</b> [1] - 120:16</p> <p><b>incomplete</b> [1] - 99:18</p> <p><b>inconvenient</b> [1] - 71:25</p> <p><b>increase</b> [1] - 154:17</p> <p><b>independent</b> [2] - 197:5, 220:8</p> <p><b>index</b> [5] - 60:21, 62:19, 69:5, 69:9, 265:24</p> <p><b>indexed</b> [3] - 59:25, 60:17, 63:11</p> <p><b>indexing</b> [1] - 59:1</p> <p><b>indicate</b> [3] - 56:17, 172:19, 247:12</p> <p><b>indicated</b> [3] - 216:10, 229:23, 269:23</p> <p><b>indicates</b> [2] - 82:12, 201:16</p> <p><b>indication</b> [3] - 130:25, 246:11, 263:6</p> <p><b>indicator</b> [1] - 247:6</p> <p><b>indirectly</b> [2] - 46:23, 72:25</p> <p><b>individual</b> [6] - 154:16, 167:2, 178:12, 207:25, 225:9, 267:8</p> <p><b>industry</b> [7] - 35:13, 98:21, 113:4, 198:13, 214:2, 214:3, 231:13</p> <p><b>inefficient</b> [1] - 135:1</p>
<b>I</b>				
<p><b>I/O</b> [12] - 134:4, 134:9, 134:24, 159:16, 171:9, 174:13, 175:25, 177:14, 178:6, 178:8, 248:23, 249:13</p> <p><b>IBM</b> [3] - 156:5, 157:20, 157:25</p> <p><b>ID</b> [8] - 46:18, 61:10, 145:8, 223:8, 223:10, 225:2, 225:5, 225:16</p> <p><b>IDE</b> [1] - 160:17</p> <p><b>idea</b> [6] - 53:6, 53:24, 132:10, 144:4, 200:8, 222:10</p> <p><b>identification</b> [1] - 99:8</p> <p><b>identified</b> [4] - 18:7, 108:4, 112:11, 175:20</p> <p><b>identifies</b> [1] - 256:22</p>				

<p><b>infinite</b> <sup>[1]</sup> - 84:1</p> <p><b>information</b> <sup>[9]</sup> - 12:9, 12:13, 12:24, 13:3, 13:10, 13:11, 13:13, 20:20, 21:19, 66:20, 77:14, 79:4, 94:14, 113:16, 114:2, 114:23, 121:8, 121:14, 121:20, 121:22, 123:3, 123:12, 124:7, 126:10, 126:24, 127:14, 129:9, 133:6, 137:5, 138:12, 138:15, 138:21, 139:25, 140:22, 141:6, 148:16, 148:19, 148:24, 149:5, 149:14, 150:7, 150:15, 150:16, 150:25, 153:9, 154:24, 164:1, 164:3, 164:11, 165:17, 168:8, 176:5, 178:9, 203:12, 207:2, 218:9, 218:16, 218:18, 218:22, 220:13, 220:20, 221:20, 221:22, 222:1, 223:1, 226:7, 230:10, 230:21, 233:6, 235:1, 237:13, 239:22, 240:1, 240:7, 240:11, 240:14, 240:16, 240:24, 241:16, 254:21, 255:17, 256:23, 262:5, 262:21, 262:23, 263:15, 270:5, 270:6, 270:10, 270:23</p> <p><b>infrastructure</b> <sup>[6]</sup> - 26:9, 26:13, 80:25, 187:25, 203:1, 249:5</p> <p><b>infringement</b> <sup>[3]</sup> - 9:9, 9:12, 11:5</p> <p><b>initialization</b> <sup>[7]</sup> - 212:19, 215:19, 217:2, 217:5, 217:8, 217:14, 218:5</p> <p><b>initialize</b> <sup>[3]</sup> - 210:2, 216:19, 216:23</p> <p><b>initialized</b> <sup>[8]</sup> - 190:18, 208:12, 208:22, 209:14, 209:15, 223:4, 249:9, 250:13</p> <p><b>initiated</b> <sup>[2]</sup> - 128:8,</p>	<p>155:15</p> <p><b>initiating</b> <sup>[1]</sup> - 227:1</p> <p><b>initiator</b> <sup>[9]</sup> - 129:15, 130:16, 131:11, 143:2, 145:2, 153:10, 153:16, 165:16</p> <p><b>injunction</b> <sup>[1]</sup> - 9:17</p> <p><b>inserting</b> <sup>[2]</sup> - 118:12, 136:18</p> <p><b>inside</b> <sup>[28]</sup> - 10:22, 25:25, 70:7, 73:23, 74:8, 83:14, 93:22, 94:15, 96:23, 105:21, 109:11, 109:15, 118:15, 190:15, 202:4, 207:24, 210:25, 211:14, 225:12, 228:19, 230:3, 233:1, 235:18, 242:1, 248:16, 249:4, 268:7, 270:17</p> <p><b>inspect</b> <sup>[1]</sup> - 48:20</p> <p><b>instance</b> <sup>[14]</sup> - 23:16, 31:21, 61:5, 67:7, 73:18, 93:18, 121:16, 130:23, 138:19, 143:23, 191:3, 207:7, 232:24, 248:12</p> <p><b>instances</b> <sup>[2]</sup> - 109:9, 109:14</p> <p><b>instead</b> <sup>[3]</sup> - 166:9, 206:14, 268:15</p> <p><b>institute</b> <sup>[1]</sup> - 54:17</p> <p><b>institution</b> <sup>[1]</sup> - 99:17</p> <p><b>instructed</b> <sup>[1]</sup> - 148:14</p> <p><b>instruction</b> <sup>[2]</sup> - 25:18, 221:9</p> <p><b>Instructions</b> <sup>[1]</sup> - 22:7</p> <p><b>instructs</b> <sup>[1]</sup> - 221:5</p> <p><b>integrity</b> <sup>[1]</sup> - 144:25</p> <p><b>Intel</b> <sup>[1]</sup> - 160:7</p> <p><b>Inter</b> <sup>[2]</sup> - 5:15, 107:16</p> <p><b>interacting</b> <sup>[1]</sup> - 101:4</p> <p><b>interaction</b> <sup>[1]</sup> - 100:25</p> <p><b>interactions</b> <sup>[1]</sup> - 40:15</p> <p><b>interchange</b> <sup>[1]</sup> - 40:6</p> <p><b>interchangeability</b> <sup>[1]</sup> - 32:2</p> <p><b>Interconnect</b> <sup>[5]</sup> - 113:3, 119:2, 136:22, 175:3, 260:4</p> <p><b>interconnect</b> <sup>[4]</sup> - 31:16, 112:15, 167:1, 198:15</p> <p><b>interconnected</b> <sup>[1]</sup> -</p>	<p>35:19</p> <p><b>interconnecting</b> <sup>[1]</sup> - 214:23</p> <p><b>interconnection</b> <sup>[1]</sup> - 137:2</p> <p><b>interest</b> <sup>[2]</sup> - 24:24, 50:23</p> <p><b>interested</b> <sup>[8]</sup> - 26:17, 62:25, 64:11, 64:15, 64:22, 86:11, 107:2, 275:18</p> <p><b>interface</b> <sup>[114]</sup> - 45:9, 126:16, 145:11, 145:14, 155:16, 155:18, 159:14, 160:13, 161:1, 163:4, 163:8, 189:15, 191:10, 191:25, 192:1, 192:23, 192:25, 193:15, 193:16, 193:24, 194:20, 195:3, 198:8, 198:13, 199:12, 199:16, 199:21, 200:1, 202:14, 204:23, 204:24, 205:2, 205:3, 205:9, 205:20, 206:8, 206:13, 206:14, 206:18, 206:19, 207:3, 207:6, 207:10, 207:11, 207:13, 208:8, 209:1, 209:5, 209:13, 210:9, 210:14, 210:22, 210:24, 211:22, 211:25, 212:9, 212:21, 213:17, 214:14, 214:16, 216:12, 216:15, 216:21, 217:6, 217:16, 217:21, 217:24, 218:10, 218:12, 218:17, 219:20, 220:22, 221:1, 221:2, 221:20, 222:3, 228:2, 229:21, 230:9, 230:19, 231:4, 235:12, 235:24, 235:25, 236:18, 237:17, 237:18, 237:20, 237:21, 237:22, 237:25, 238:17, 238:24, 239:7, 242:18, 242:24, 242:25, 243:1,</p>	<p>243:6, 243:23, 248:9, 249:8, 250:6, 250:7, 250:10, 250:15, 250:23, 251:9, 251:11, 253:22, 255:6</p> <p><b>interfaces</b> <sup>[10]</sup> - 160:7, 160:14, 160:16, 160:24, 190:9, 199:4, 199:11, 212:20, 216:19, 246:10</p> <p><b>interfacing</b> <sup>[1]</sup> - 159:15</p> <p><b>Interlocken</b> <sup>[1]</sup> - 2:13</p> <p><b>internal</b> <sup>[7]</sup> - 53:14, 56:9, 66:18, 102:5, 102:9, 102:10, 104:8</p> <p><b>internally</b> <sup>[1]</sup> - 204:7</p> <p><b>international</b> <sup>[2]</sup> - 61:12, 92:25</p> <p><b>internet</b> <sup>[15]</sup> - 21:15, 61:18, 61:20, 61:23, 62:6, 72:8, 72:9, 72:15, 77:10, 78:14, 80:1, 80:4, 80:14, 80:15, 81:14</p> <p><b>Internet</b> <sup>[4]</sup> - 85:23, 86:3, 86:19, 89:13</p> <p><b>interoperable</b> <sup>[2]</sup> - 187:19, 200:20</p> <p><b>interpret</b> <sup>[3]</sup> - 183:18, 191:14, 196:2</p> <p><b>interpretation</b> <sup>[25]</sup> - 107:18, 108:18, 109:7, 109:10, 109:13, 110:14, 110:15, 110:16, 110:19, 110:21, 111:1, 111:4, 111:9, 113:7, 113:8, 120:23, 140:19, 156:1, 163:20, 166:21, 168:5, 169:10, 255:15, 259:3, 262:1</p> <p><b>interpreted</b> <sup>[4]</sup> - 110:5, 137:10, 240:7, 262:2</p> <p><b>interpreter</b> <sup>[1]</sup> - 85:15</p> <p><b>interrelate</b> <sup>[1]</sup> - 30:13</p> <p><b>interrupt</b> <sup>[3]</sup> - 134:23, 134:25, 153:2</p> <p><b>interrupted</b> <sup>[1]</sup> - 7:22</p> <p><b>intervening</b> <sup>[3]</sup> - 161:6, 161:9, 260:3</p> <p><b>introduce</b> <sup>[2]</sup> - 171:13, 236:10</p> <p><b>introduced</b> <sup>[2]</sup> - 10:6, 83:22</p>	<p><b>introducing</b> <sup>[1]</sup> - 84:18</p> <p><b>introductory</b> <sup>[1]</sup> - 170:23</p> <p><b>invalid</b> <sup>[7]</sup> - 57:10, 58:15, 122:12, 122:13, 144:2, 171:25, 172:1</p> <p><b>invalidate</b> <sup>[2]</sup> - 136:12, 170:15</p> <p><b>invalided</b> <sup>[1]</sup> - 253:10</p> <p><b>invalidity</b> <sup>[2]</sup> - 171:19, 171:22</p> <p><b>invented</b> <sup>[9]</sup> - 80:11, 83:4, 157:6, 157:11, 175:10, 203:21, 216:5, 228:20, 231:16</p> <p><b>invention</b> <sup>[7]</sup> - 187:8, 188:11, 189:19, 190:1, 194:4, 194:8, 194:10</p> <p><b>inventor</b> <sup>[4]</sup> - 151:8, 153:7, 170:15, 186:17</p> <p><b>inventors</b> <sup>[1]</sup> - 231:15</p> <p><b>invested</b> <sup>[1]</sup> - 97:9</p> <p><b>investigate</b> <sup>[1]</sup> - 44:24</p> <p><b>involved</b> <sup>[21]</sup> - 6:20, 7:8, 7:24, 9:7, 9:8, 39:4, 42:3, 42:16, 43:11, 46:11, 46:12, 46:23, 47:3, 48:12, 65:24, 105:25, 106:6, 106:15, 106:18, 191:3, 269:18</p> <p><b>involving</b> <sup>[1]</sup> - 7:2</p> <p><b>Ion</b> <sup>[1]</sup> - 45:14</p> <p><b>IP</b> <sup>[3]</sup> - 6:21, 99:3, 99:5</p> <p><b>IPR</b> <sup>[14]</sup> - 5:24, 5:25, 6:3, 12:5, 37:7, 85:22, 115:17, 115:18, 124:16, 157:23, 173:7, 173:16, 173:22</p> <p><b>IPR2014</b> <sup>[1]</sup> - 6:4</p> <p><b>IPR2014-01462</b> <sup>[2]</sup> - 1:12, 5:16</p> <p><b>IPR2014-01469</b> <sup>[2]</sup> - 1:13, 6:1</p> <p><b>IPRs</b> <sup>[3]</sup> - 99:11, 115:13, 163:23</p> <p><b>IRDY</b> <sup>[2]</sup> - 143:3, 144:8</p> <p><b>Iron</b> <sup>[1]</sup> - 45:17</p> <p><b>irrelevant</b> <sup>[1]</sup> - 99:18</p> <p><b>ISA</b> <sup>[1]</sup> - 160:17</p> <p><b>isolate</b> <sup>[1]</sup> - 88:13</p> <p><b>issue</b> <sup>[6]</sup> - 54:21, 107:5, 147:14,</p>
--	--	--	---	--

172:14, 173:16, 232:15 <b>issued</b> [1] - 9:14 <b>issues</b> [3] - 61:21, 84:16, 177:8 <b>IT</b> [1] - 95:20 <b>item</b> [1] - 22:4 <b>items</b> [1] - 158:14 <b>iterated</b> [1] - 70:10 <b>iterative</b> [1] - 125:9 <b>itself</b> [6] - 46:7, 61:14, 76:22, 181:9, 240:16, 267:7	275:6 <b>knowing</b> [3] - 143:17, 146:11, 252:16 <b>knowledge</b> [12] - 10:19, 11:12, 30:9, 32:25, 33:14, 33:23, 34:12, 65:18, 67:13, 94:24, 172:11, 195:4 <b>known</b> [12] - 32:8, 32:12, 32:13, 32:14, 33:11, 33:13, 36:20, 44:3, 62:14, 176:6, 232:18, 253:16 <b>knows</b> [2] - 211:23, 228:15 <b>Kohmann</b> [1] - 40:7	245:1 <b>late</b> [2] - 19:23, 59:11 <b>law</b> [9] - 6:14, 6:21, 10:18, 28:20, 44:6, 61:24, 62:7, 92:13, 234:15 <b>Lawrence</b> [1] - 24:17 <b>laws</b> [1] - 6:21 <b>lay</b> [1] - 269:16 <b>layer</b> [5] - 196:25, 230:11, 230:24, 248:15, 248:16 <b>lays</b> [1] - 117:25 <b>LCB</b> [2] - 56:11, 56:12 <b>leader</b> [2] - 38:7, 40:5 <b>leading</b> [2] - 7:4, 97:24 <b>learn</b> [2] - 33:3 <b>learning</b> [1] - 32:22 <b>least</b> [17] - 42:12, 42:13, 44:8, 55:7, 61:7, 73:24, 77:3, 104:25, 105:14, 135:11, 193:14, 200:16, 215:18, 238:14, 255:19, 256:2, 270:9 <b>leave</b> [6] - 29:2, 61:13, 115:1, 115:3, 122:23, 124:3 <b>Leave</b> [1] - 208:13 <b>leaves</b> [3] - 210:25, 253:18, 255:6 <b>leaving</b> [1] - 50:24 <b>left</b> [4] - 142:18, 198:6, 224:10, 266:8 <b>left-hand</b> [1] - 142:18 <b>leftover</b> [2] - 223:25, 246:17 <b>legitimate</b> [1] - 261:10 <b>length</b> [11] - 130:11, 130:14, 143:10, 143:13, 143:21, 143:22, 244:4, 247:2, 247:3, 247:5, 247:12 <b>less</b> [7] - 17:25, 36:8, 52:10, 149:1, 150:21, 235:7, 245:20 <b>letter</b> [3] - 84:17, 156:24, 157:4 <b>Letters</b> [5] - 70:16, 70:23, 71:2, 71:5, 72:5 <b>letters</b> [3] - 71:1, 156:23, 157:11 <b>level</b> [24] - 23:21, 25:17, 25:21, 29:1, 29:16, 29:18, 29:21, 34:4, 34:13, 54:23,	74:11, 74:24, 127:22, 128:21, 195:25, 199:2, 202:6, 204:14, 213:5, 213:7, 213:23, 216:3, 216:10, 251:4 <b>levels</b> [1] - 196:1 <b>LHC</b> [34] - 43:20, 43:21, 44:15, 52:7, 52:9, 52:19, 54:5, 56:14, 65:10, 67:6, 68:10, 73:14, 73:16, 100:11, 100:13, 100:15, 100:17, 100:19, 100:23, 100:24, 100:25, 101:6, 101:8, 101:10, 101:12, 101:20, 102:20, 103:19, 104:7, 105:25, 106:6, 106:18, 106:23, 107:5 <b>LHC-B</b> [17] - 100:11, 100:13, 100:15, 100:17, 100:23, 100:24, 101:6, 101:8, 101:10, 101:12, 101:20, 102:20, 104:7, 105:25, 106:6, 106:18, 107:5 <b>LHC-related</b> [1] - 73:14 <b>LHCb</b> [2] - 3:10, 101:10 <b>LHCC</b> [23] - 52:3, 52:6, 52:8, 52:15, 52:20, 54:10, 54:13, 55:10, 55:23, 56:4, 56:9, 56:19, 58:2, 59:8, 66:9, 67:24, 68:6, 73:10, 73:13, 75:14, 75:25, 76:4, 102:15 <b>libraries</b> [4] - 67:16, 67:17, 72:12, 75:20 <b>library</b> [57] - 59:1, 60:11, 60:17, 60:20, 60:22, 60:25, 61:2, 61:11, 61:17, 61:19, 63:5, 63:7, 63:10, 63:14, 63:15, 63:18, 64:2, 64:4, 65:7, 65:14, 65:17, 65:20, 65:22, 66:2, 66:8, 66:20, 67:1, 67:6, 67:9, 67:15, 67:19, 68:7, 68:11, 68:15, 68:18, 69:8, 69:11,	69:17, 69:20, 69:22, 70:17, 70:20, 71:17, 72:4, 72:8, 72:24, 73:4, 75:15, 77:8, 77:10, 87:16, 89:1, 96:10, 96:15, 271:8 <b>library's</b> [2] - 67:13, 68:23 <b>license</b> [2] - 70:24, 72:9 <b>life</b> [1] - 24:24 <b>light</b> [7] - 45:19, 75:3, 107:18, 110:10, 111:4, 111:9, 234:10 <b>likely</b> [8] - 33:16, 76:13, 88:7, 90:6, 99:19, 185:12, 272:20, 272:22 <b>limit</b> [3] - 23:10, 120:18, 184:13 <b>limitation</b> [6] - 116:19, 121:2, 123:6, 162:17, 163:5, 196:22 <b>limitations</b> [3] - 116:19, 117:1, 157:6 <b>limited</b> [4] - 130:11, 164:5, 181:8, 181:14 <b>limiting</b> [1] - 175:11 <b>limits</b> [1] - 55:20 <b>LINDENSTRUTH</b> [4] - 1:19, 4:1, 274:2, 274:21 <b>Lindenstruth</b> [8] - 3:4, 4:11, 4:15, 4:17, 5:17, 99:23, 107:12, 273:5 <b>Line</b> [1] - 274:7 <b>line</b> [22] - 84:13, 113:23, 130:24, 136:8, 149:6, 180:7, 181:11, 181:21, 183:3, 199:17, 199:21, 199:22, 206:19, 206:20, 214:23, 248:3, 249:17, 250:22, 253:9, 253:10, 253:14, 253:15 <b>lines</b> [26] - 30:25, 128:25, 129:1, 142:18, 144:8, 144:11, 144:13, 145:18, 146:5, 148:17, 148:20, 148:21, 150:13, 150:15, 154:16, 180:25, 181:12, 181:14, 181:15, 181:16, 181:17,
<b>J</b>				
<b>J-1</b> [1] - 50:21 <b>James</b> [1] - 182:9 <b>January</b> [1] - 86:4 <b>job</b> [4] - 7:18, 26:14, 258:17, 258:18 <b>joined</b> [1] - 46:8 <b>joint</b> [2] - 40:12, 98:21 <b>jointly</b> [2] - 15:1, 97:23 <b>judge</b> [2] - 10:15, 10:23 <b>jumping</b> [1] - 248:14 <b>Jury</b> [1] - 22:6	<b>L</b>			
	<b>lab</b> [1] - 50:12 <b>label</b> [1] - 152:12 <b>labeled</b> [1] - 129:6 <b>labels</b> [1] - 76:23 <b>Laboratory</b> [2] - 24:17, 42:7 <b>laboratory</b> [1] - 74:22 <b>labs</b> [1] - 48:25 <b>Labs</b> [2] - 216:2, 271:24 <b>lacks</b> [1] - 99:19 <b>laid</b> [1] - 133:11 <b>LAN</b> [1] - 216:17 <b>land</b> [1] - 219:19 <b>language</b> [15] - 78:22, 83:4, 83:8, 125:7, 127:2, 140:4, 147:24, 156:4, 156:5, 156:10, 166:10, 166:15, 173:24, 174:25, 188:22 <b>laptop</b> [3] - 91:24, 233:1, 233:2 <b>large</b> [16] - 22:16, 26:4, 26:8, 41:25, 55:7, 100:8, 160:15, 190:20, 201:10, 216:8, 216:14, 217:2, 266:25, 269:24, 272:17 <b>large-scale</b> [1] - 272:17 <b>larger</b> [7] - 18:5, 35:12, 35:17, 55:15, 55:16, 65:3 <b>last</b> [13] - 7:22, 11:23, 11:24, 38:5, 38:6, 59:10, 63:25, 139:6, 143:24, 161:24, 168:19, 231:21,			
<b>K</b>				
<b>Kare</b> [1] - 40:7 <b>keep</b> [7] - 7:18, 17:12, 51:3, 66:14, 95:4, 149:4, 211:13 <b>keeps</b> [1] - 25:20 <b>kept</b> [2] - 103:9, 105:2 <b>key</b> [1] - 210:23 <b>keyboard</b> [1] - 160:23 <b>kilobytes</b> [2] - 265:15, 265:17 <b>kind</b> [35] - 6:17, 6:18, 11:9, 13:6, 25:18, 29:10, 29:16, 30:20, 41:6, 42:10, 43:20, 45:22, 48:15, 50:19, 56:7, 83:6, 83:7, 84:13, 85:7, 97:12, 136:4, 153:21, 189:5, 190:11, 201:12, 202:7, 202:8, 204:5, 205:23, 208:15, 213:6, 233:23, 234:2, 238:25, 251:25 <b>kinds</b> [4] - 47:10, 54:14, 64:14, 248:25 <b>KINGDOM</b> [1] - 275:2 <b>Kingdom</b> [2] - 6:9,				

181:18, 183:22, 184:6, 187:3 <b>link</b> [15] - 69:1, 81:10, 82:7, 82:8, 82:18, 200:18, 200:19, 201:5, 203:8, 203:14, 238:4, 247:11, 251:6, 254:11 <b>linked</b> [4] - 78:23, 79:11, 81:14, 85:1 <b>linking</b> [1] - 78:14 <b>links</b> [12] - 81:8, 96:22, 196:17, 197:13, 198:11, 200:6, 200:9, 200:24, 201:4, 201:9, 202:12, 245:22 <b>list</b> [8] - 22:20, 22:23, 38:9, 70:25, 98:3, 103:17, 135:6, 144:21 <b>listed</b> [3] - 18:13, 22:5, 274:6 <b>listen</b> [2] - 75:5, 165:6 <b>lists</b> [1] - 60:11 <b>literally</b> [2] - 45:1, 251:5 <b>literature</b> [1] - 69:24 <b>litigation</b> [5] - 12:4, 12:10, 12:14, 13:9, 72:16 <b>live</b> [1] - 207:24 <b>lives</b> [1] - 207:22 <b>LLC</b> [1] - 1:8 <b>LLP</b> [3] - 2:4, 2:12, 4:9 <b>loaded</b> [1] - 187:13 <b>local</b> [11] - 124:11, 125:8, 131:18, 178:8, 207:21, 215:10, 224:8, 225:17, 226:19, 229:1, 268:5 <b>locate</b> [2] - 63:3, 174:10 <b>located</b> [3] - 92:8, 93:4, 93:12 <b>location</b> [1] - 178:6 <b>logic</b> [3] - 198:13, 212:2, 231:24 <b>logical</b> [1] - 183:8 <b>London</b> [2] - 1:21, 275:6 <b>long-term</b> [1] - 45:20 <b>look</b> [32] - 5:23, 16:5, 23:1, 28:23, 31:24, 37:13, 45:24, 49:13, 77:1, 80:21, 83:16, 83:17, 90:10, 96:7, 102:13, 113:22, 115:15, 127:1, 135:4, 153:3, 158:7, 166:13, 167:19, 169:14, 182:12, 184:17, 184:20, 192:21, 192:22, 204:10, 238:4, 243:4 <b>looked</b> [10] - 22:7, 42:17, 84:3, 86:1, 89:7, 152:20, 154:22, 158:4, 234:24, 259:10 <b>looking</b> [45] - 31:1, 36:4, 37:16, 43:5, 57:22, 57:23, 58:1, 68:24, 82:1, 87:19, 116:1, 116:2, 124:6, 128:1, 132:15, 133:4, 133:14, 142:5, 142:14, 146:1, 146:18, 146:23, 152:8, 159:23, 159:25, 168:14, 173:24, 179:11, 179:24, 187:15, 187:16, 192:13, 192:20, 195:10, 197:7, 199:9, 199:14, 213:16, 235:10, 250:21, 259:4, 264:16, 266:4, 266:14 <b>looks</b> [4] - 13:19, 212:5, 242:19, 253:12 <b>lookup</b> [4] - 212:1, 263:9, 263:14, 265:15 <b>losing</b> [1] - 237:9 <b>lost</b> [1] - 184:8 <b>love</b> [1] - 14:6 <b>low</b> [15] - 128:9, 129:2, 135:24, 140:11, 145:17, 168:20, 183:2, 183:9, 196:5, 231:12, 231:14, 231:22, 232:5, 232:15, 232:19 <b>low-voltage</b> [8] - 168:20, 183:2, 183:9, 231:12, 231:14, 231:22, 232:5, 232:19 <b>lower</b> [2] - 139:23, 267:2 <b>Lucent</b> [3] - 12:13, 12:14, 12:25 <b>lucky</b> [1] - 270:20 <b>lunch</b> [3] - 141:12, 141:13, 141:18 <b>LVDS</b> [28] - 116:4, 116:9, 116:11, 118:20, 118:24, 119:14, 119:22, 166:16, 167:21, 167:24, 181:15, 182:16, 182:18, 182:21, 183:1, 183:7, 183:18, 183:23, 184:5, 197:3, 231:13, 231:15, 231:16, 232:7, 232:18, 232:21, 232:23, 260:5 <b>Löchsen</b> [1] - 40:7	129:10, 147:18, 148:4, 148:5, 149:3, 153:2, 154:4, 156:11, 158:9, 158:23, 159:6, 159:10, 160:5, 166:24, 169:2, 169:13, 170:22, 172:7, 172:14, 173:19, 174:24, 174:25, 179:20, 181:5, 183:1, 184:11, 185:19, 189:25, 193:5, 193:20, 195:24, 197:25, 200:13, 201:6, 203:16, 207:6, 213:2, 213:22, 213:25, 214:9, 214:11, 215:24, 219:1, 223:16, 226:14, 227:17, 228:13, 228:23, 229:10, 231:3, 232:23, 233:20, 234:5, 237:16, 238:1, 238:8, 241:7, 241:21, 243:3, 246:22, 247:24, 249:24, 253:24, 256:17, 258:23, 259:9, 259:12, 259:25, 261:24, 262:8, 263:9, 263:13, 263:14, 268:2, 269:3, 272:1 <b>meaning</b> [15] - 108:24, 110:6, 110:19, 110:25, 111:8, 122:15, 129:8, 139:19, 150:25, 183:8, 185:15, 227:12, 252:24, 265:1, 267:9 <b>meaningless</b> [1] - 58:20 <b>meanings</b> [2] - 130:19, 153:14 <b>means</b> [40] - 25:7, 26:6, 28:19, 31:18, 42:2, 43:15, 56:5, 56:12, 61:8, 63:12, 71:15, 93:12, 96:18, 110:25, 113:11, 120:17, 128:20, 128:23, 137:2, 137:24, 148:24, 156:20, 163:18, 172:23, 178:18, 178:21, 187:11, 211:11, 227:2, 228:8, 268:18, 269:14, 270:19 <b>maps</b> [2] - 156:13, 270:16 <b>marked</b> [4] - 85:21, 99:7, 157:22, 173:8 <b>market</b> [2] - 107:1, 272:14 <b>mass</b> [6] - 31:10, 31:15, 119:6, 119:18, 196:10, 205:21 <b>master</b> [10] - 34:13, 129:12, 129:21, 131:10, 131:24, 131:25, 145:13, 155:15, 165:16 <b>masters</b> [1] - 215:14 <b>match</b> [3] - 18:4, 253:9, 268:8 <b>material</b> [10] - 14:24, 16:16, 17:2, 18:7, 36:24, 55:19, 55:21, 69:22, 98:22, 271:11 <b>materials</b> [5] - 15:14, 18:12, 22:3, 23:2, 86:2 <b>mathematics</b> [1] - 32:22 <b>matrix</b> [1] - 31:16 <b>matter</b> [9] - 63:1, 63:12, 81:13, 128:23, 176:4, 209:9, 241:10, 266:12, 275:18 <b>matters</b> [1] - 12:5 <b>Max</b> [1] - 5:5 <b>maximum</b> [1] - 237:7 <b>MBIVR</b> [1] - 1:22 <b>ME</b> [1] - 274:22 <b>mean</b> [126] - 7:5, 9:18, 14:23, 15:16, 16:22, 18:1, 18:8, 19:7, 21:24, 22:10, 23:4, 30:11, 30:22, 34:8, 36:10, 37:24, 39:19, 40:22, 41:15, 44:15, 50:12, 58:13, 59:20, 60:20, 63:4, 63:6, 66:14, 66:22, 72:5, 75:8, 77:7, 77:8, 89:25, 91:21, 93:13, 96:18, 100:5, 103:23, 104:18, 106:8, 106:20, 109:2, 109:19, 110:24, 113:3, 114:13, 117:16, 126:13, 127:17,
<b>M</b>	
<b>M-a-i-n-z</b> [1] - 5:11 <b>machine</b> [7] - 35:10, 79:12, 79:18, 94:13, 100:21, 104:2, 275:9 <b>machines</b> [5] - 79:13, 79:20, 79:22, 81:6, 93:19 <b>macro</b> [1] - 189:17 <b>magazine</b> [6] - 70:15, 70:24, 71:15, 71:16, 71:24, 72:10 <b>magazines</b> [1] - 71:13 <b>magnet</b> [1] - 42:10 <b>main</b> [13] - 118:19, 119:13, 119:20, 160:9, 182:9, 196:20, 196:22, 198:11, 224:4, 253:21, 254:20, 265:7, 266:21 <b>maintain</b> [1] - 105:8 <b>maintained</b> [2] - 188:1, 228:24 <b>maintenance</b> [1] - 80:7 <b>Mainz</b> [1] - 5:11 <b>major</b> [2] - 100:18, 128:5 <b>majority</b> [1] - 47:21 <b>Management</b> [1] - 74:6 <b>management</b> [1] - 96:21 <b>mandatory</b> [7] - 134:7, 135:18, 136:5, 136:8, 136:14, 136:15, 144:4 <b>map</b> [11] - 176:20, 177:10, 178:10, 179:3, 179:7,	

187:25, 203:10,  
203:14, 207:23,  
214:15, 227:6,  
244:11, 246:3,  
246:6, 251:23,  
252:8, 265:16,  
266:25  
**meant** [10] - 108:22,  
108:23, 108:25,  
111:8, 126:2,  
126:13, 166:2,  
166:12, 174:3, 214:3  
**measured** [1] - 75:2  
**measuring** [2] - 74:17,  
74:18  
**mechanical** [1] - 49:21  
**mechanism** [1] -  
217:1  
**media** [2] - 26:7, 74:21  
**medications** [1] - 8:3  
**medicine** [1] - 38:6  
**meet** [8] - 17:6,  
117:22, 122:7,  
123:5, 123:14,  
165:1, 185:17,  
185:18  
**meeting** [1] - 56:7  
**meetings** [3] - 17:23,  
47:11, 48:18  
**meets** [2] - 233:10,  
233:11  
**megabytes** [1] - 224:4  
**megahertz** [1] - 26:6  
**member** [7] - 46:24,  
61:4, 61:5, 73:18,  
100:9, 101:20,  
158:25  
**members** [1] - 158:15  
**memories** [1] - 268:15  
**memory** [71] - 17:1,  
56:23, 58:7, 58:12,  
85:16, 118:19,  
119:6, 119:13,  
119:20, 134:1,  
134:5, 134:8,  
134:14, 135:15,  
136:7, 136:11,  
159:15, 160:9,  
174:11, 178:8,  
195:12, 195:24,  
196:11, 196:20,  
196:23, 198:11,  
206:7, 211:11,  
212:13, 216:9,  
216:11, 220:2,  
220:3, 224:1, 224:5,  
224:6, 226:19,  
227:19, 228:17,  
228:18, 228:19,  
228:22, 229:2,

229:7, 229:14,  
229:18, 229:20,  
230:17, 243:15,  
248:23, 249:10,  
249:20, 251:11,  
251:13, 251:16,  
252:11, 253:6,  
253:14, 253:21,  
254:7, 254:14,  
254:20, 255:19,  
262:7, 262:19,  
265:7, 266:21,  
268:18, 268:19  
**memory** [1] - 223:22  
**mention** [5] - 21:3,  
21:6, 121:7, 188:6,  
253:18  
**mentioned** [7] - 28:2,  
39:9, 42:21, 47:14,  
47:15, 172:17, 257:1  
**mentioning** [1] - 21:11  
**meson** [2] - 101:3,  
101:8  
**MESON** [1] - 101:3  
**message** [10] - 15:16,  
21:22, 165:9,  
220:15, 228:23,  
228:25, 229:3,  
229:17, 229:21,  
262:10  
**message-passing** [4]  
- 228:23, 228:25,  
229:17, 229:21  
**met** [5] - 72:2, 164:18,  
260:15, 260:16  
**meters** [2] - 214:12,  
232:4  
**method** [2] - 118:7,  
118:8  
**mezzanine** [1] - 49:16  
**microprocessor** [14] -  
118:19, 119:5,  
119:13, 119:18,  
119:21, 161:6,  
161:9, 161:14,  
161:20, 196:10,  
198:15, 260:3,  
265:6, 267:4  
**microscope** [1] -  
27:17  
**microscopy** [1] -  
27:15  
**MicroSystems** [1] -  
79:19  
**middle** [2] - 29:22,  
224:10  
**midpoint** [1] - 183:4  
**might** [8] - 26:20,  
28:11, 80:10, 108:4,  
164:21, 166:5,

226:18, 232:4  
**milliampere** [1] -  
183:5  
**millimeters** [1] - 49:15  
**million** [6] - 171:5,  
178:22, 178:23,  
207:23, 207:25,  
229:10  
**millions** [2] - 26:5,  
91:8  
**mind** [14] - 18:15,  
66:15, 75:19, 89:8,  
96:9, 110:9, 133:8,  
137:17, 182:13,  
205:25, 206:3,  
206:22, 211:13,  
270:22  
**mine** [1] - 15:17  
**minimize** [1] - 44:19  
**minimum** [9] - 8:25,  
54:18, 104:10,  
131:21, 145:11,  
162:20, 237:6,  
239:21, 253:20  
**minor** [3] - 15:9, 38:1,  
125:12  
**minus** [3] - 16:8, 35:9,  
89:1  
**minute** [3] - 7:7,  
59:10, 253:6  
**missing** [1] - 239:9  
**misspoke** [2] - 174:20,  
257:12  
**mister** [1] - 21:4  
**misunderstanding** [1]  
- 91:23  
**mitigation** [1] - 74:3  
**Model** [1] - 22:6  
**modified** [1] - 83:11  
**modular** [11] - 30:22,  
31:3, 31:18, 32:6,  
33:23, 34:16, 35:4,  
35:19, 35:23, 44:25,  
118:23  
**module** [4] - 50:3,  
118:12, 118:16,  
195:17  
**modules** [1] - 195:13  
**modulo** [1] - 224:16  
**moment** [6] - 10:12,  
18:14, 62:21, 135:3,  
255:5, 255:7  
**money** [6] - 8:11,  
24:20, 49:1, 49:3,  
93:18, 236:9  
**monitor** [2] - 52:17,  
73:13  
**monolithic** [1] - 31:21  
**months** [2] - 47:23,  
52:21

**Moore's** [1] - 44:6  
**morning** [1] - 142:15  
**most** [20] - 8:10, 9:2,  
23:20, 23:23, 25:20,  
26:12, 28:8, 28:10,  
38:15, 39:4, 49:24,  
80:5, 88:7, 134:13,  
136:15, 172:11,  
172:12, 185:12,  
219:9, 272:22  
**mostly** [3] - 130:7,  
193:22, 212:17  
**Motorola** [2] - 197:22,  
198:16  
**Moufang** [1] - 4:23  
**MOUFANG** [1] - 4:24  
**mouse** [1] - 160:24  
**move** [2] - 183:6,  
272:25  
**moved** [1] - 24:16  
**MR** [321] - 4:4, 4:8,  
4:14, 13:18, 14:5,  
14:8, 14:10, 14:11,  
32:4, 32:10, 33:17,  
34:1, 34:14, 41:14,  
42:11, 46:9, 57:16,  
57:21, 58:8, 58:9,  
59:4, 59:15, 59:19,  
60:4, 62:8, 63:8,  
63:20, 63:21, 64:6,  
64:13, 64:19, 64:21,  
66:13, 67:11, 67:22,  
67:23, 68:1, 68:4,  
73:7, 73:8, 75:17,  
75:22, 77:5, 77:12,  
81:23, 81:24, 82:5,  
82:6, 85:5, 85:19,  
86:6, 86:9, 86:14,  
86:15, 86:24, 87:1,  
87:7, 87:10, 87:18,  
88:2, 89:3, 89:10,  
89:17, 89:22, 91:1,  
91:2, 91:19, 91:25,  
92:5, 92:14, 92:21,  
93:24, 94:12, 94:19,  
95:10, 95:15, 96:16,  
96:24, 97:4, 97:16,  
97:19, 98:4, 98:12,  
99:9, 99:15, 99:22,  
101:17, 102:12,  
102:24, 103:2,  
103:22, 104:3,  
104:13, 104:14,  
104:16, 104:22,  
105:7, 105:12,  
105:18, 105:23,  
107:11, 110:22,  
110:23, 111:2,  
111:6, 111:17,  
111:21, 111:24,

112:1, 112:3, 112:6,  
115:21, 117:23,  
118:4, 118:22,  
119:10, 119:16,  
119:23, 121:9,  
121:18, 122:10,  
122:16, 123:25,  
124:8, 124:13,  
124:17, 124:19,  
137:8, 137:15,  
137:21, 138:3,  
139:5, 139:12,  
141:11, 141:14,  
142:8, 142:10,  
145:22, 145:23,  
147:10, 147:12,  
147:20, 147:21,  
149:8, 149:19,  
150:1, 150:6,  
150:10, 150:12,  
150:18, 151:2,  
153:1, 153:23,  
154:3, 154:20,  
155:3, 155:5,  
155:12, 155:19,  
162:13, 162:19,  
162:24, 163:10,  
164:19, 164:20,  
165:25, 166:23,  
167:6, 173:18,  
173:21, 175:18,  
176:2, 176:8, 176:9,  
179:13, 179:14,  
180:21, 180:24,  
181:22, 181:25,  
182:5, 182:6, 185:6,  
185:13, 185:25,  
186:6, 187:21,  
188:4, 190:3, 190:7,  
191:16, 191:19,  
195:14, 195:15,  
197:16, 197:19,  
197:24, 198:2,  
198:21, 198:22,  
198:24, 199:8,  
199:19, 199:24,  
200:12, 200:21,  
201:1, 201:2, 202:9,  
202:16, 202:17,  
202:19, 203:6,  
203:13, 204:8,  
204:13, 204:20,  
205:13, 205:16,  
207:4, 207:8,  
213:21, 214:6,  
215:8, 215:11,  
215:22, 217:11,  
218:3, 218:7,  
218:20, 218:21,  
218:25, 220:16,  
223:13, 223:23,



226:3, 226:4,  
226:10, 227:5,  
230:14, 230:20,  
234:21, 235:8,  
235:16, 237:11,  
239:15, 239:16,  
239:24, 240:3,  
240:9, 240:19,  
241:1, 241:2, 241:6,  
241:9, 241:20,  
242:4, 242:7, 243:2,  
243:12, 244:23,  
245:4, 245:9,  
245:17, 245:23,  
246:13, 246:20,  
246:24, 247:14,  
247:18, 247:23,  
248:1, 248:7, 250:3,  
250:19, 250:20,  
253:23, 254:1,  
254:17, 254:18,  
254:22, 255:2,  
255:21, 255:24,  
256:4, 256:20,  
256:24, 257:2,  
257:18, 257:21,  
257:24, 257:25,  
258:12, 258:13,  
258:22, 259:1,  
259:8, 259:18,  
259:24, 260:10,  
260:24, 260:25,  
261:17, 262:3,  
262:25, 263:12,  
267:21, 267:22,  
267:25, 268:13,  
268:20, 268:21,  
268:24, 268:25,  
269:2, 269:9,  
269:15, 270:3,  
270:12, 271:1,  
272:25  
**multi** [1] - 213:8  
**multi-parallel** [1] -  
213:8  
**multiple** [17] - 35:11,  
117:20, 118:9,  
120:5, 120:7, 125:4,  
130:24, 135:15,  
211:5, 215:13,  
220:3, 220:8, 244:2,  
244:12, 249:17,  
266:21, 268:15  
**multiplexed** [1] -  
129:7  
**multiprocessor** [1] -  
179:7  
**must** [12] - 10:19,  
62:13, 64:10, 81:5,  
113:15, 121:21,

122:8, 127:1,  
130:13, 136:1,  
156:1, 169:11  
**Müller** [34] - 20:23,  
21:4, 21:7, 38:14,  
39:3, 39:11, 40:16,  
41:4, 41:7, 46:10,  
66:1, 76:2, 77:18,  
78:6, 79:4, 79:13,  
80:10, 90:6, 91:15,  
92:3, 94:21, 97:13,  
97:20, 97:25, 100:1,  
100:2, 102:20,  
104:1, 105:1,  
105:14, 105:15,  
106:17  
**Müller's** [1] - 78:24

## N

**N.W** [1] - 2:5  
**name** [9] - 4:5, 4:8,  
4:16, 10:8, 42:6,  
51:19, 100:24,  
153:12, 153:20  
**namely** [1] - 249:13  
**names** [2] - 48:11,  
73:22  
**nasty** [1] - 78:1  
**national** [2] - 50:23,  
182:21  
**National** [2] - 24:17,  
42:7  
**naturally** [1] - 147:4  
**nature** [2] - 8:8, 25:22  
**near** [1] - 127:19  
**necessarily** [3] -  
64:20, 93:15, 226:2  
**necessary** [7] - 5:2,  
46:6, 133:7, 154:7,  
186:20, 204:3, 225:8  
**need** [28] - 14:4,  
41:20, 43:12, 57:17,  
62:4, 96:7, 114:22,  
124:10, 127:10,  
127:16, 151:7,  
155:9, 159:21,  
172:25, 186:3,  
188:7, 188:25,  
189:10, 218:22,  
219:12, 223:7,  
236:19, 245:21,  
249:16, 249:18,  
249:19, 251:7, 265:1  
**needed** [15] - 25:1,  
27:17, 41:24, 42:1,  
85:14, 121:14,  
154:24, 186:12,  
190:21, 194:1,  
218:18, 222:1,

224:5, 227:3, 249:4  
**needs** [8] - 27:23,  
75:9, 101:5, 131:3,  
190:17, 236:16,  
236:20  
**negative** [5] - 77:21,  
78:1, 78:3, 141:25,  
231:21  
**neglecting** [1] - 272:7  
**net** [1] - 185:9  
**nets** [1] - 196:18  
**network** [34] - 31:10,  
45:6, 68:23, 91:14,  
92:8, 92:10, 92:12,  
92:16, 160:24,  
185:10, 189:18,  
190:16, 201:4,  
201:7, 201:13,  
201:17, 202:22,  
203:15, 203:16,  
204:4, 212:12,  
213:10, 214:14,  
220:14, 223:12,  
226:8, 236:11,  
241:12, 246:7,  
251:18, 251:19,  
259:16, 272:13  
**network-based** [1] -  
68:23  
**networking** [2] -  
201:23, 202:8  
**networks** [6] - 91:22,  
143:12, 201:15,  
202:23, 203:2, 247:4  
**never** [13] - 6:22,  
18:23, 53:20, 61:20,  
66:17, 69:3, 102:8,  
103:4, 133:25,  
236:9, 256:21,  
260:13  
**new** [18] - 74:11,  
147:14, 175:7,  
177:6, 186:12,  
187:18, 188:7,  
188:12, 188:16,  
189:22, 190:1,  
191:9, 191:10,  
191:12, 191:20,  
191:22, 194:11,  
269:13  
**news** [1] - 165:7  
**next** [13] - 26:24, 51:1,  
57:9, 58:10, 63:9,  
87:14, 108:7, 136:7,  
144:3, 199:5, 211:9,  
217:19, 230:12  
**nice** [9] - 14:5, 14:8,  
24:21, 26:16, 39:14,  
79:15, 131:22,  
223:16, 238:23

**nicely** [5] - 130:1,  
131:7, 144:16,  
223:17, 245:12  
**nicer** [2] - 27:22,  
132:19  
**nine** [2] - 39:20, 239:5  
**no** [2] - 78:2, 78:4  
**nobody** [5] - 27:25,  
61:5, 93:7, 130:14,  
164:10  
**node** [17] - 202:24,  
225:2, 225:12,  
225:16, 226:13,  
226:15, 226:18,  
229:2, 229:9,  
229:14, 243:8,  
268:4, 268:7, 269:5,  
270:21  
**node-to-node** [1] -  
202:24  
**nodes** [15] - 31:9,  
32:2, 45:2, 171:6,  
178:23, 209:16,  
210:5, 210:7, 225:9,  
227:25, 228:19,  
229:13, 269:25  
**noise** [1] - 74:21  
**noisy** [1] - 27:19  
**nomenclature** [1] -  
215:3  
**non** [4] - 19:5, 72:12,  
177:17, 272:8  
**non-coherent** [1] -  
272:8  
**non-disclosure** [1] -  
19:5  
**non-trivial** [1] - 72:12  
**non-working** [1] -  
177:17  
**nonsense** [3] - 84:6,  
84:14, 229:12  
**normal** [8] - 17:5,  
25:23, 32:18, 41:1,  
65:21, 67:19, 68:6,  
133:25  
**normally** [4] - 8:16,  
55:18, 102:4, 233:20  
**north** [9] - 116:12,  
116:20, 119:7,  
161:19, 163:14,  
167:25, 196:13,  
196:21, 258:2  
**northbridge** [35] -  
116:18, 117:20,  
118:19, 119:13,  
119:19, 119:22,  
119:24, 120:11,  
120:20, 121:2,  
121:21, 122:8,  
123:1, 123:5,

123:10, 133:5,  
133:9, 159:7,  
159:10, 159:17,  
160:6, 161:13,  
161:18, 163:25,  
164:15, 164:24,  
176:7, 196:15,  
196:24, 197:2,  
240:23, 259:7,  
270:11  
**nosy** [1] - 252:6  
**NOT** [1] - 76:14  
**not** [1] - 77:22  
**Note** [2] - 100:15,  
101:14  
**note** [8] - 87:23,  
100:11, 100:17,  
101:10, 101:11,  
102:5, 102:19, 151:8  
**noted** [1] - 275:11  
**notes** [3] - 101:15,  
101:16, 102:8  
**nothing** [18] - 15:10,  
18:14, 26:14, 40:25,  
60:23, 89:8, 93:3,  
177:21, 178:20,  
202:3, 208:13,  
209:17, 213:2,  
217:4, 249:2, 257:8,  
261:3, 264:7  
**notice** [4] - 131:16,  
137:22, 138:24,  
157:7  
**noticed** [5] - 16:17,  
23:12, 41:17, 48:3,  
75:1  
**noting** [1] - 101:9  
**novel** [1] - 193:7  
**nuclear** [11] - 24:13,  
24:22, 24:25, 25:12,  
25:16, 25:21, 26:20,  
26:23, 27:4, 43:17,  
65:3  
**nucleus** [1] - 25:25  
**number** [47] - 5:24,  
16:6, 16:9, 54:4,  
55:11, 56:8, 79:25,  
80:1, 80:3, 80:10,  
80:12, 101:12,  
101:14, 103:16,  
103:25, 115:20,  
115:24, 115:25,  
122:22, 129:2,  
130:10, 144:8,  
148:25, 152:13,  
154:18, 159:8,  
160:15, 174:16,  
192:17, 194:19,  
201:10, 201:25,  
216:8, 235:2,

264:24, 264:25,  
265:2, 265:18,  
265:19, 265:21,  
265:24, 265:25,  
266:23, 267:2,  
269:25

**numbering** [1] - 99:11

**numbers** [9] - 5:19,  
5:23, 18:3, 28:11,  
37:9, 37:10, 82:10,  
89:7, 265:2

## O

**oath** [4] - 90:1, 94:1,  
185:19, 234:6

**object** [2] - 139:5,  
155:4

**objection** [141] -  
32:10, 34:1, 41:14,  
58:8, 59:4, 59:19,  
62:8, 63:20, 64:6,  
64:19, 66:13, 67:22,  
68:1, 73:7, 75:17,  
77:5, 81:23, 82:5,  
85:5, 86:6, 86:14,  
86:24, 87:7, 87:18,  
89:3, 89:17, 91:1,  
91:19, 92:5, 92:21,  
94:12, 95:10, 96:16,  
97:4, 97:19, 98:12,  
101:17, 102:24,  
103:22, 104:13,  
105:7, 105:8,  
105:18, 110:22,  
111:2, 117:23,  
118:22, 119:16,  
121:9, 122:10,  
123:25, 137:8,  
137:21, 145:22,  
147:10, 147:20,  
149:8, 150:1,  
150:10, 150:18,  
153:1, 154:3, 155:4,  
155:12, 162:13,  
162:24, 164:19,  
166:23, 173:18,  
175:18, 176:8,  
179:13, 180:21,  
181:22, 182:5,  
185:6, 187:21,  
190:3, 191:16,  
195:14, 197:16,  
197:24, 198:21,  
198:24, 199:19,  
200:12, 201:2,  
202:16, 202:19,  
203:13, 204:13,  
207:4, 213:21,  
215:8, 215:22,  
218:3, 218:20,

218:25, 223:13,  
226:3, 226:10,  
230:14, 234:21,  
235:16, 239:15,  
239:24, 240:9,  
241:1, 241:6,  
241:20, 243:2,  
244:23, 245:9,  
245:23, 246:20,  
247:14, 247:23,  
248:7, 250:19,  
253:23, 254:17,  
254:22, 255:21,  
256:4, 256:24,  
257:18, 257:24,  
258:12, 258:22,  
259:8, 259:24,  
260:24, 261:17,  
262:25, 267:21,  
267:25, 268:20,  
268:24, 269:2,  
269:15, 270:12

**objections** [1] - 99:16

**obligations** [1] - 107:1

**obvious** [10] - 29:10,  
36:19, 46:4, 89:8,  
127:18, 129:11,  
190:11, 221:16,  
238:3, 258:16

**obviously** [26] - 10:9,  
17:4, 57:6, 57:8,  
80:11, 94:24,  
100:24, 124:22,  
131:9, 131:19,  
149:1, 163:3, 163:6,  
163:7, 164:13,  
182:2, 182:15,  
185:21, 199:3,  
211:23, 216:2,  
221:8, 227:19,  
238:12, 254:8,  
263:10

**obviousness** [3] -  
172:9, 172:12,  
172:14

**occur** [2] - 114:16,  
117:17

**October** [12] - 4:18,  
11:23, 11:24, 56:16,  
59:18, 60:12, 86:3,  
86:12, 87:22, 89:13,  
102:15, 110:9

**odd** [1] - 246:4

**OF** [2] - 274:1, 274:23

**off-the-shelf** [2] -  
192:5, 193:3

**offer** [2] - 28:13, 241:4

**offered** [2] - 26:25,  
62:14

**OFFICE** [1] - 1:1

**office** [1] - 4:22

**Office** [3] - 5:14,

19:14, 19:20

**offices** [1] - 1:20

**official** [5] - 80:3,  
90:13, 90:21, 95:18,  
163:1

**offset** [1] - 246:5

**often** [6] - 27:24,  
43:18, 71:22, 94:8,  
246:2, 246:7

**old** [3] - 35:7, 160:11,  
229:16

**omitted** [1] - 197:1

**once** [12] - 8:24, 10:5,  
37:14, 50:18, 70:12,  
70:14, 125:5, 157:2,  
178:7, 211:17,  
236:15, 236:18

**one** [228] - 5:20, 8:18,  
9:3, 9:11, 11:7, 14:6,  
15:4, 20:22, 21:20,  
22:3, 22:4, 22:11,  
23:19, 25:7, 26:10,  
29:3, 30:8, 31:9,  
31:21, 31:23, 32:1,  
32:22, 33:6, 37:7,  
37:25, 41:5, 42:21,  
42:22, 45:21, 48:8,  
48:24, 49:10, 49:11,  
49:19, 50:11, 51:2,  
54:5, 55:7, 57:3,  
57:14, 59:8, 60:23,  
60:24, 64:14, 66:6,  
72:13, 73:20, 77:9,  
79:12, 79:16, 79:17,  
79:20, 80:12, 80:18,  
82:2, 82:3, 82:22,  
83:23, 84:13, 85:24,  
86:12, 87:21, 88:6,  
90:18, 93:8, 97:13,  
99:1, 100:19, 101:5,  
102:4, 108:5,  
111:16, 112:21,  
116:4, 116:5, 116:7,  
117:17, 117:22,  
118:2, 118:11,  
120:17, 120:18,  
120:21, 124:16,  
125:17, 126:3,  
131:16, 131:21,  
134:22, 139:7,  
140:10, 142:13,  
143:14, 143:24,  
144:17, 146:11,  
148:16, 148:17,  
149:10, 149:15,  
151:22, 154:13,  
155:17, 156:14,  
156:16, 156:17,

156:21, 156:22,  
156:24, 157:1,  
157:17, 158:6,  
160:4, 163:9,  
164:23, 165:5,  
167:3, 167:8,  
167:14, 171:4,  
171:7, 171:12,  
172:11, 172:17,  
176:22, 176:23,  
177:5, 177:8, 178:5,  
179:3, 179:4, 179:5,  
181:7, 182:9,  
182:16, 183:5,  
186:9, 188:9,  
189:16, 190:11,  
191:13, 192:16,  
193:20, 194:17,  
195:25, 196:1,  
199:10, 200:1,  
202:10, 204:18,  
204:23, 205:3,  
205:10, 206:7,  
207:23, 207:25,  
208:24, 209:3,  
209:20, 209:24,  
210:20, 211:7,  
212:10, 212:14,  
213:16, 215:18,  
217:1, 217:19,  
219:15, 220:4,  
221:17, 224:1,  
224:11, 225:14,  
226:12, 227:4,  
227:22, 229:11,  
230:15, 231:3,  
232:4, 233:13,  
236:2, 237:21,  
238:9, 240:20,  
241:3, 243:16,  
244:2, 244:15,  
245:2, 245:20,  
245:24, 246:18,  
247:15, 249:21,  
250:7, 251:2, 255:9,  
258:7, 258:9,  
259:12, 260:19,  
260:20, 261:12,  
264:12, 264:21,  
265:12, 266:24,  
268:9, 268:16,  
269:13, 270:18

**one-command-per-  
line** [1] - 84:13

**one-step** [1] - 266:24

**one-to-one** [8] - 87:21,  
156:21, 156:24,  
157:1, 157:17,  
190:11, 244:15,  
249:21

**one-way** [3] - 164:23,  
165:5, 167:8

**ones** [6] - 42:15, 55:1,  
120:7, 134:7,  
135:14, 167:4

**oneself** [1] - 227:23

**ongoing** [8] - 12:17,  
67:3, 71:20, 118:2,  
140:23, 190:25,  
236:24, 244:11

**online** [3] - 44:15,  
44:22, 106:9

**oops** [1] - 115:19

**open** [3] - 10:25,  
84:22, 125:5

**openly** [1] - 272:13

**operate** [2] - 188:13,  
215:14

**operates** [1] - 215:5

**operating** [5] - 91:12,  
93:2, 171:24, 187:9,  
187:12

**Operation** [1] - 128:7  
**operation** [2] - 43:24,  
73:16

**opinion** [6] - 23:5,  
94:1, 99:20, 103:8,  
104:16, 259:19

**opinions** [3] - 36:18,  
108:9, 241:3

**opposed** [7] - 11:12,  
12:5, 29:8, 36:15,  
36:17, 184:6, 219:13

**opposite** [7] - 116:11,  
119:3, 136:23,  
167:3, 168:22,  
175:4, 196:9

**optimum** [1] - 236:8

**optional** [10] - 134:3,  
134:11, 135:11,  
135:12, 135:16,  
135:17, 135:20,  
136:8, 136:9, 136:14

**options** [2] - 57:3,  
80:13

**orally** [1] - 52:25

**order** [35] - 9:4, 22:9,  
23:10, 32:11, 34:20,  
43:13, 44:13, 44:18,  
49:4, 53:10, 53:14,  
61:1, 97:14, 120:13,  
132:3, 144:5, 149:4,  
170:15, 171:22,  
175:10, 194:6,  
194:11, 199:5,  
201:9, 201:19,  
201:20, 207:18,  
208:10, 211:11,  
218:23, 227:21,  
256:11, 257:7,

269:18, 270:13 <b>Order</b> [1] - 13:14 <b>ordering</b> [1] - 127:21 <b>Orders</b> [1] - 13:8 <b>ordinarily</b> [1] - 63:1 <b>ordinary</b> [16] - 26:7, 29:18, 36:11, 37:3, 41:1, 69:21, 80:18, 110:6, 110:19, 110:25, 111:7, 149:17, 204:17, 212:13, 213:6, 270:2 <b>ordinary-skill-in-the-</b> <b>art</b> [1] - 213:6 <b>organization</b> [3] - 61:12, 92:25, 95:12 <b>organizations</b> [1] - 93:2 <b>organized</b> [1] - 95:19 <b>original</b> [3] - 183:14, 232:7, 262:9 <b>originate</b> [1] - 242:14 <b>originated</b> [1] - 262:6 <b>Oslo</b> [4] - 39:24, 39:25, 40:3, 49:7 <b>otherwise</b> [17] - 50:1, 52:11, 62:24, 65:16, 110:5, 122:14, 131:12, 134:21, 139:25, 169:7, 186:21, 209:22, 213:12, 216:16, 225:5, 237:9, 261:15 <b>ourselves</b> [1] - 4:5 <b>outcome</b> [1] - 275:18 <b>outline</b> [6] - 43:12, 92:23, 104:20, 159:13, 201:14, 268:2 <b>outlined</b> [12] - 35:15, 41:20, 57:3, 130:1, 135:7, 144:17, 171:3, 172:6, 190:23, 218:5, 238:10, 259:10 <b>outlines</b> [2] - 150:2, 191:17 <b>output</b> [1] - 191:14 <b>outrage</b> [1] - 51:14 <b>outside</b> [10] - 20:15, 52:22, 96:6, 99:16, 101:17, 105:4, 165:4, 216:15, 224:7, 265:5 <b>outstanding</b> [1] - 54:19 <b>overall</b> [3] - 89:6, 158:20, 176:19 <b>overlap</b> [1] - 178:16 <b>overloaded</b> [1] -	201:21 <b>overlooked</b> [3] - 132:21, 152:5, 263:7 <b>oversimplifying</b> [2] - 203:16, 265:22 <b>own</b> [17] - 10:8, 35:4, 36:16, 53:20, 67:16, 68:10, 80:9, 93:5, 93:10, 97:7, 187:4, 207:21, 207:22, 207:24, 209:9, 268:4 <b>owned</b> [8] - 22:17, 90:24, 91:8, 92:18, 93:14, 93:15, 93:23, 94:5 <b>Owner</b> [3] - 1:9, 19:13, 20:1 <b>OWNER</b> [1] - 2:11 <b>owner</b> [2] - 9:18, 93:8 <b>Owner's</b> [2] - 20:5, 20:10 <b>ownership</b> [1] - 93:16 <b>ownerships</b> [1] - 93:11 <b>owns</b> [4] - 92:23, 95:9, 95:13, 97:1	270:8 <b>pad</b> [2] - 246:18, 246:21 <b>padded</b> [1] - 247:6 <b>padding</b> [1] - 247:3 <b>Page</b> [3] - 3:3, 3:9, 274:7 <b>page</b> [73] - 17:2, 18:9, 37:22, 38:22, 62:21, 73:21, 78:24, 83:3, 83:7, 84:12, 86:7, 86:13, 87:4, 88:19, 89:7, 90:13, 90:14, 90:20, 103:24, 107:13, 109:18, 113:23, 119:12, 125:14, 125:20, 125:22, 126:3, 126:25, 127:7, 127:19, 128:3, 130:4, 130:5, 142:6, 142:8, 142:11, 144:16, 144:22, 144:23, 145:10, 148:10, 152:20, 153:3, 159:24, 159:25, 169:19, 170:9, 172:6, 184:9, 184:10, 186:8, 192:12, 225:21, 241:4, 264:17, 265:8, 265:15, 265:18, 265:19, 265:21, 265:24, 265:25, 266:4, 266:5, 266:6, 266:8, 266:15, 266:17, 266:22, 267:2, 275:12 <b>pages</b> [14] - 15:3, 15:5, 77:10, 81:18, 84:11, 87:14, 90:21, 96:22, 98:2, 98:7, 107:9, 132:24, 157:24, 265:8 <b>paid</b> [3] - 8:24, 35:14, 91:9 <b>painful</b> [1] - 50:24 <b>pair</b> [2] - 203:22, 203:25 <b>pairs</b> [1] - 167:10 <b>paper</b> [18] - 69:23, 69:25, 70:5, 70:10, 70:14, 71:18, 71:22, 71:23, 71:24, 72:2, 72:4, 72:14, 74:2, 74:14, 85:18, 102:6, 177:12, 215:25 <b>papers</b> [2] - 69:25, 271:12	<b>paragraph</b> [43] - 28:9, 28:11, 28:13, 28:20, 28:25, 37:15, 57:22, 60:8, 62:21, 64:3, 64:7, 76:11, 78:14, 78:18, 82:1, 86:17, 87:11, 107:13, 111:25, 112:8, 113:12, 125:1, 125:19, 133:16, 146:1, 151:4, 151:24, 151:25, 155:22, 155:24, 170:8, 179:23, 183:20, 184:10, 186:7, 188:9, 191:7, 194:19, 194:23, 195:1, 209:24, 241:13, 267:12 <b>parallel</b> [9] - 29:12, 33:7, 34:8, 154:18, 171:4, 191:1, 213:8, 224:21, 265:14 <b>parity</b> [1] - 144:24 <b>part</b> [57] - 22:16, 28:5, 33:10, 40:11, 47:19, 48:17, 50:16, 54:10, 60:22, 63:25, 64:17, 67:19, 68:5, 72:4, 72:23, 73:4, 81:18, 84:23, 90:11, 90:21, 92:24, 97:7, 118:20, 119:15, 119:25, 133:13, 139:23, 139:24, 144:18, 145:19, 146:5, 150:24, 152:16, 152:21, 166:10, 167:4, 171:18, 174:4, 175:14, 175:16, 176:19, 177:9, 178:2, 182:20, 187:12, 193:6, 205:5, 207:10, 212:22, 215:25, 220:14, 223:2, 241:18, 247:21, 251:11, 256:15, 259:2 <b>Partes</b> [2] - 5:15, 107:16 <b>participants</b> [1] - 275:11 <b>particle</b> [3] - 74:12, 75:2, 101:3 <b>particles</b> [1] - 45:19 <b>particular</b> [94] - 10:10, 10:12, 17:13, 30:5, 31:12, 33:13, 38:18, 38:20, 39:1, 42:10,	43:18, 44:4, 48:12, 51:6, 51:20, 53:16, 55:13, 58:14, 65:1, 65:2, 66:19, 68:14, 71:15, 75:21, 80:2, 82:21, 83:16, 86:7, 90:8, 90:18, 93:10, 98:18, 102:2, 102:4, 102:6, 102:11, 105:10, 106:22, 107:3, 107:5, 117:16, 120:19, 120:21, 125:22, 132:15, 140:24, 143:12, 148:6, 154:8, 155:17, 158:25, 161:7, 169:13, 172:8, 174:10, 174:11, 177:25, 184:13, 189:8, 189:16, 190:25, 192:11, 193:5, 194:18, 199:6, 201:10, 207:19, 207:20, 208:3, 208:6, 209:6, 210:5, 210:6, 210:21, 214:17, 215:10, 221:9, 224:19, 226:12, 226:16, 232:6, 233:15, 235:24, 236:17, 247:17, 248:10, 263:8, 263:25, 264:5, 264:6, 268:10, 269:20, 270:15 <b>particularly</b> [2] - 30:2, 212:2 <b>parties</b> [2] - 275:15, 275:17 <b>parts</b> [1] - 126:18 <b>pass</b> [1] - 250:16 <b>passage</b> [1] - 167:8 <b>passed</b> [2] - 25:9, 230:9 <b>passing</b> [4] - 228:23, 228:25, 229:17, 229:21 <b>past</b> [2] - 8:9, 69:17 <b>PATENT</b> [3] - 1:1, 1:2, 2:11 <b>patent</b> [65] - 5:22, 8:21, 9:9, 9:14, 9:17, 9:18, 22:21, 28:15, 28:20, 29:10, 61:24, 62:7, 62:15, 62:17, 98:23, 109:11, 109:15, 109:17, 109:25, 110:1,
---	--	---	---	---

110:8, 115:16, 116:1, 121:24, 123:24, 124:6, 140:3, 145:21, 150:2, 150:5, 151:20, 159:4, 160:19, 161:24, 162:12, 165:5, 168:14, 169:15, 170:4, 171:3, 179:9, 179:16, 180:20, 180:23, 182:25, 183:18, 183:22, 184:7, 190:23, 191:11, 191:24, 192:10, 192:13, 192:18, 193:4, 193:6, 197:5, 213:25, 233:16, 234:9, 234:10, 234:15, 256:10, 258:15 <b>Patent</b> [46] - 1:9, 1:12, 1:13, 5:14, 5:25, 6:3, 19:12, 19:14, 19:19, 19:25, 20:5, 20:10, 22:6, 23:17, 29:7, 37:8, 59:24, 108:25, 115:18, 116:2, 127:8, 140:9, 146:22, 151:5, 152:3, 159:7, 159:11, 161:23, 163:12, 163:25, 179:22, 179:25, 180:3, 184:1, 187:3, 188:16, 188:21, 191:17, 191:24, 233:12, 233:25, 257:3, 257:4, 258:14, 259:22, 259:23 <b>patented</b> [3] - 62:15, 186:10, 188:11 <b>patentholder</b> [1] - 4:9 <b>patents</b> [12] - 17:1, 19:17, 22:16, 22:17, 22:21, 23:2, 23:6, 23:24, 109:19, 162:10, 179:9, 235:4 <b>Patents</b> [1] - 186:17 <b>path</b> [6] - 190:12, 201:21, 209:2, 214:15, 216:23, 222:8 <b>paths</b> [1] - 201:18 <b>Patterson</b> [1] - 264:11 <b>pause</b> [3] - 107:10, 147:11, 155:3 <b>pay</b> [1] - 97:14	<b>payload</b> [4] - 254:23, 255:20, 256:2, 270:25 <b>PC</b> [2] - 155:2, 197:22 <b>PCI</b> [442] - 38:18, 41:17, 42:1, 42:20, 42:25, 47:16, 47:20, 49:12, 49:16, 49:17, 49:18, 49:20, 49:24, 112:15, 112:19, 112:23, 112:25, 113:14, 113:15, 113:17, 114:1, 114:2, 114:4, 114:6, 114:15, 114:16, 114:17, 114:20, 114:22, 114:24, 114:25, 115:7, 115:8, 115:11, 116:15, 116:21, 117:2, 117:17, 117:24, 117:25, 118:2, 119:2, 120:1, 120:5, 120:11, 120:12, 120:19, 120:22, 121:11, 121:15, 121:17, 121:22, 122:1, 122:9, 122:12, 122:19, 123:3, 123:7, 123:19, 123:23, 124:2, 124:11, 124:24, 125:8, 125:20, 126:6, 126:9, 126:11, 126:15, 127:14, 128:7, 128:10, 129:4, 129:6, 130:13, 131:3, 131:11, 133:11, 133:18, 133:19, 133:24, 134:20, 136:22, 137:3, 137:4, 137:6, 137:18, 137:19, 137:25, 138:6, 138:13, 138:22, 139:8, 139:9, 139:10, 139:15, 139:18, 139:20, 139:24, 140:5, 140:14, 140:18, 140:21, 140:22, 141:1, 141:5, 142:5, 142:18, 143:16, 144:7, 144:11, 144:21, 145:11, 145:20, 146:1, 146:3, 146:6, 146:9, 146:25, 147:3, 147:9, 147:16,	147:19, 148:2, 148:25, 149:7, 149:16, 149:18, 149:22, 149:24, 150:7, 150:9, 150:14, 150:16, 150:23, 151:1, 151:12, 152:17, 152:23, 153:9, 153:13, 153:19, 153:20, 153:24, 154:1, 154:6, 154:11, 154:25, 155:14, 155:16, 160:1, 160:3, 160:13, 160:14, 161:6, 163:2, 164:16, 164:24, 165:11, 165:12, 165:20, 167:5, 168:1, 168:8, 169:1, 169:3, 169:6, 171:15, 173:12, 174:2, 174:3, 174:5, 174:13, 174:14, 174:23, 175:4, 175:5, 175:8, 175:14, 176:6, 176:12, 176:15, 176:22, 177:7, 177:19, 177:23, 178:1, 178:12, 178:14, 178:19, 178:24, 178:25, 179:4, 179:10, 181:9, 181:21, 184:15, 184:25, 185:4, 187:13, 187:24, 187:25, 188:23, 189:1, 189:4, 189:15, 189:17, 189:21, 190:13, 190:14, 190:25, 191:13, 191:14, 193:23, 194:6, 194:8, 194:20, 195:4, 195:5, 196:8, 196:14, 196:16, 196:19, 197:3, 197:12, 197:13, 197:23, 198:15, 199:12, 199:16, 199:20, 199:25, 200:1, 202:14, 202:15, 205:3, 205:8, 205:10, 206:12, 206:13, 206:15, 206:20, 206:25, 208:3, 208:11, 208:14,	208:16, 208:25, 209:12, 210:6, 210:9, 210:14, 210:15, 210:17, 210:21, 210:24, 211:8, 212:9, 212:11, 212:14, 212:16, 212:20, 213:17, 213:18, 213:20, 213:23, 214:2, 214:3, 214:5, 214:8, 214:14, 214:16, 214:18, 214:21, 214:22, 214:24, 215:1, 215:3, 215:6, 215:10, 215:13, 215:20, 215:21, 216:18, 216:20, 217:5, 217:9, 217:20, 217:24, 217:25, 218:1, 218:2, 218:10, 218:11, 218:12, 218:17, 218:18, 218:23, 219:14, 219:16, 219:20, 219:21, 219:24, 220:13, 220:18, 221:2, 221:9, 221:11, 221:12, 221:19, 221:23, 222:1, 222:3, 223:3, 225:25, 226:1, 226:6, 226:8, 226:17, 227:4, 235:24, 236:20, 236:21, 237:2, 237:14, 238:6, 238:14, 239:10, 239:12, 239:17, 239:23, 240:8, 240:12, 240:17, 240:24, 241:17, 241:18, 241:22, 241:24, 241:25, 242:10, 242:13, 242:14, 242:18, 242:23, 242:24, 243:1, 243:5, 243:14, 243:19, 243:20, 243:22, 244:3, 244:8, 244:12, 244:18, 244:20, 245:6, 246:15, 247:10, 247:20, 248:5, 248:10, 248:12, 248:22, 249:8, 249:13, 249:22, 250:5, 250:6,	254:13, 254:20, 254:24, 255:3, 255:6, 255:14, 255:15, 255:17, 255:20, 256:22, 256:25, 257:6, 257:7, 257:15, 257:16, 257:20, 257:23, 258:3, 258:6, 258:8, 258:11, 258:20, 259:6, 259:16, 259:20, 260:1, 260:4, 260:6, 260:12, 260:20, 261:2, 261:8, 261:13, 261:14, 261:18, 261:19, 261:23, 262:6, 262:7, 262:9, 262:17, 262:18, 262:22, 263:15, 267:15, 267:19, 268:6, 268:17, 268:22, 269:4, 269:12, 270:1, 270:6, 270:10, 270:17, 270:23, 270:24 <b>PCI</b> [1] - 198:20 <b>PCI-compliant</b> [1] - 214:5 <b>PCI-related</b> [2] - 153:9, 153:13 <b>PCI-required</b> [1] - 153:24 <b>PCI-SCI</b> [10] - 38:18, 41:17, 42:1, 42:20, 42:25, 47:16, 47:20, 49:12, 212:11, 219:16 <b>PCI-TNet</b> [2] - 210:9, 210:14 <b>PCI-to-PCI</b> [1] - 160:3 <b>PCI-to-TNet</b> [1] - 210:6 <b>PCL</b> [3] - 197:22, 198:19, 199:23 <b>PCN</b> [1] - 181:12 <b>PCNR</b> [1] - 181:13 <b>PD0</b> [1] - 181:12 <b>PD3</b> [1] - 181:12 <b>PDF</b> [6] - 82:24, 83:3, 83:21, 84:18, 84:24, 86:20 <b>PDF</b> [1] - 86:23 <b>PDR0</b> [1] - 181:13 <b>PDR3</b> [1] - 181:13 <b>peer</b> [1] - 190:17 <b>penalty</b> [1] - 6:13
--	---	---	---	---

<p><b>pending</b> [1] - 12:4</p> <p><b>people</b> [34] - 25:23, 39:4, 40:20, 41:1, 46:5, 47:17, 48:10, 48:21, 54:14, 54:15, 54:23, 55:9, 55:21, 64:15, 65:6, 65:9, 70:9, 83:25, 84:22, 95:3, 97:25, 105:24, 106:6, 106:12, 106:15, 157:7, 201:19, 208:25, 219:15, 228:22, 228:23, 229:17, 229:18, 229:20</p> <p><b>per</b> [2] - 16:1, 84:13</p> <p><b>percent</b> [5] - 16:8, 46:14, 144:15, 234:16, 272:4</p> <p><b>percolates</b> [1] - 212:6</p> <p><b>perfect</b> [1] - 84:4</p> <p><b>perfectly</b> [2] - 60:24, 251:2</p> <p><b>perform</b> [4] - 211:20, 217:2, 230:2, 251:12</p> <p><b>performance</b> [3] - 49:7, 212:17, 219:17</p> <p><b>performed</b> [2] - 12:19, 118:9</p> <p><b>performing</b> [5] - 53:18, 108:8, 120:11, 120:14, 190:19</p> <p><b>perhaps</b> [1] - 250:24</p> <p><b>period</b> [2] - 44:7, 53:16</p> <p><b>periodic</b> [1] - 54:11</p> <p><b>peripheral</b> [26] - 112:14, 137:1, 160:18, 160:21, 160:25, 161:5, 161:7, 161:9, 161:25, 162:4, 162:9, 162:14, 162:17, 162:22, 163:2, 163:3, 163:8, 167:1, 192:1, 192:25, 193:16, 198:14, 240:23, 260:2, 260:5, 260:11</p> <p><b>Peripheral</b> [3] - 136:21, 175:3, 260:4</p> <p><b>peripherals</b> [1] - 186:13</p> <p><b>periphery</b> [2] - 160:13, 160:22</p> <p><b>perjury</b> [1] - 6:13</p> <p><b>person</b> [29] - 11:11, 17:18, 17:20, 20:22, 28:14, 28:17, 28:22,</p>	<p>29:23, 32:9, 33:18, 33:20, 33:22, 36:6, 36:10, 36:15, 36:21, 37:3, 40:18, 48:7, 64:16, 90:18, 92:9, 92:11, 110:7, 204:9, 204:16, 213:5, 213:6</p> <p><b>person-of-skill-in-the-art</b> [1] - 36:15</p> <p><b>personal</b> [1] - 79:21</p> <p><b>personally</b> [4] - 39:5, 75:23, 81:25, 94:5</p> <p><b>persons</b> [1] - 62:25</p> <p><b>perspective</b> [6] - 36:5, 36:6, 36:13, 36:15, 36:20, 36:22</p> <p><b>pertains</b> [1] - 169:6</p> <p><b>Petitioner</b> [1] - 1:6</p> <p><b>petitioner</b> [2] - 4:7, 12:9</p> <p><b>PETITIONER</b> [1] - 2:3</p> <p><b>phase</b> [20] - 113:16, 113:17, 114:3, 114:23, 114:24, 126:11, 126:24, 127:14, 127:15, 130:9, 131:7, 131:8, 132:11, 132:13, 137:5, 137:7, 138:5, 139:19, 144:5</p> <p><b>phases</b> [11] - 114:1, 114:7, 114:18, 126:8, 126:12, 130:11, 133:10, 133:18, 137:4, 137:25, 146:3</p> <p><b>PhD</b> [8] - 24:13, 24:22, 25:12, 26:20, 26:23, 27:10, 46:16, 98:20</p> <p><b>philosophies</b> [1] - 228:24</p> <p><b>phrase</b> [16] - 112:20, 117:1, 117:6, 136:17, 138:13, 139:15, 140:12, 146:23, 147:15, 148:3, 148:4, 154:22, 159:7, 159:9, 167:20, 168:19</p> <p><b>phrasing</b> [1] - 122:17</p> <p><b>Phys</b> [5] - 70:16, 70:23, 71:5, 71:11, 72:5</p> <p><b>phys</b> [1] - 71:8</p> <p><b>physical</b> [33] - 68:15, 71:17, 148:21, 173:11, 173:13, 174:4, 174:7, 174:9, 174:13, 174:14,</p>	<p>174:17, 174:19, 175:20, 177:25, 182:13, 183:14, 207:20, 210:11, 219:22, 224:18, 226:23, 228:8, 230:11, 230:24, 231:4, 248:16, 253:8, 265:25, 267:1, 267:2, 267:16, 268:5</p> <p><b>Physical</b> [1] - 71:2</p> <p><b>physical-to-virtual</b> [1] - 174:19</p> <p><b>physically</b> [3] - 48:20, 50:7, 245:15</p> <p><b>physics</b> [24] - 24:13, 24:22, 24:25, 25:6, 25:8, 25:12, 25:16, 25:21, 26:20, 26:24, 27:4, 27:14, 27:22, 28:6, 29:8, 43:17, 55:18, 65:4, 71:10, 74:1, 100:21</p> <p><b>PIC</b> [2] - 192:2, 192:10</p> <p><b>pick</b> [1] - 128:17</p> <p><b>picture</b> [2] - 41:4, 50:3</p> <p><b>pictures</b> [2] - 88:8</p> <p><b>piece</b> [11] - 58:12, 79:3, 85:16, 92:18, 150:16, 177:12, 189:8, 189:22, 191:20, 224:23, 269:12</p> <p><b>pieces</b> [12] - 30:13, 35:16, 38:16, 87:25, 88:12, 88:22, 135:9, 154:24, 193:17, 223:1, 240:24, 247:20</p> <p><b>pin</b> [2] - 144:21, 175:11</p> <p><b>pins</b> [5] - 129:7, 129:8, 145:10, 145:12</p> <p><b>pipe</b> [2] - 223:3, 262:18</p> <p><b>pitfall</b> [1] - 78:1</p> <p><b>place</b> [8] - 26:9, 52:17, 89:15, 90:9, 192:16, 206:1, 226:24, 237:20</p> <p><b>placed</b> [1] - 230:23</p> <p><b>placeholder</b> [2] - 153:13, 153:21</p> <p><b>placeholders</b> [1] - 153:25</p> <p><b>places</b> [3] - 37:23, 127:17, 192:17</p> <p><b>plagiarism</b> [2] - 10:17, 11:6</p>	<p><b>plagiarized</b> [1] - 10:11</p> <p><b>plain</b> [1] - 171:1</p> <p><b>plan</b> [1] - 272:17</p> <p><b>Planck</b> [2] - 5:5</p> <p><b>planned</b> [1] - 43:21</p> <p><b>play</b> [4] - 30:21, 49:5, 135:9, 224:20</p> <p><b>played</b> [1] - 38:3</p> <p><b>playground</b> [1] - 26:16</p> <p><b>plug</b> [1] - 49:23</p> <p><b>plugged</b> [2] - 186:23, 204:6</p> <p><b>plural</b> [1] - 120:25</p> <p><b>plus</b> [4] - 15:5, 16:8, 151:13, 221:21</p> <p><b>PMC</b> [4] - 49:15, 50:3, 50:6</p> <p><b>point</b> [43] - 20:13, 21:11, 24:11, 25:11, 33:9, 38:19, 41:8, 46:11, 63:24, 65:14, 66:24, 67:7, 79:7, 80:17, 81:11, 93:19, 95:6, 95:13, 117:18, 117:21, 118:1, 125:21, 132:21, 145:5, 146:8, 152:11, 173:1, 173:3, 182:15, 186:19, 189:3, 193:10, 193:24, 200:5, 201:9, 203:1, 209:20, 212:8, 215:14, 237:14, 263:6</p> <p><b>point-to-point</b> [2] - 201:9, 203:1</p> <p><b>pointing</b> [6] - 142:8, 208:19, 208:20, 221:1, 233:2, 263:3</p> <p><b>points</b> [2] - 71:10, 188:10</p> <p><b>port</b> [13] - 79:25, 80:1, 80:3, 80:5, 80:10, 80:15, 80:17, 80:21, 80:24, 90:21, 103:25, 104:5, 160:12</p> <p><b>portable</b> [3] - 83:21, 83:24, 84:19</p> <p><b>portion</b> [5] - 125:22, 126:6, 227:12, 245:8, 255:19</p> <p><b>portions</b> [2] - 41:12, 247:25</p> <p><b>positive</b> [1] - 124:18</p> <p><b>possibility</b> [1] - 74:16</p> <p><b>possible</b> [33] - 34:19, 66:7, 66:11, 66:12, 90:7, 100:9, 157:14,</p>	<p>161:2, 167:17, 178:22, 178:24, 194:12, 202:11, 203:21, 204:16, 209:3, 210:18, 215:17, 217:3, 219:14, 220:13, 220:18, 220:19, 224:14, 225:20, 226:20, 230:4, 247:15, 263:21, 265:13, 269:1, 269:21</p> <p><b>possibly</b> [23] - 18:4, 39:2, 59:8, 67:1, 105:21, 107:2, 135:4, 135:5, 168:13, 171:16, 196:18, 207:25, 208:4, 208:24, 209:18, 211:18, 220:5, 225:6, 229:16, 234:7, 236:24, 252:24, 270:14</p> <p><b>post</b> [3] - 24:18, 48:8, 182:20</p> <p><b>post-doc</b> [3] - 24:18, 48:8, 182:20</p> <p><b>posted</b> [4] - 40:20, 92:15, 130:2, 250:2</p> <p><b>postscript</b> [29] - 41:9, 81:20, 82:3, 82:12, 82:23, 83:1, 83:3, 83:14, 83:23, 84:10, 84:11, 84:19, 84:22, 84:23, 85:1, 85:3, 85:10, 85:11, 85:12, 85:13, 85:15, 88:9, 88:10, 88:11, 88:24, 89:12, 89:15, 90:3, 90:9</p> <p><b>postscript-enabled</b> [1] - 85:12</p> <p><b>potential</b> [5] - 88:14, 107:6, 177:24, 178:6, 227:2</p> <p><b>potentially</b> [2] - 200:1, 207:23</p> <p><b>power</b> [2] - 231:20, 233:3</p> <p><b>powerful</b> [1] - 101:5</p> <p><b>practice</b> [1] - 67:19</p> <p><b>pre</b> [3] - 219:24, 220:22, 220:25</p> <p><b>pre-configured</b> [3] - 219:24, 220:22, 220:25</p> <p><b>prearranged</b> [2] - 220:1, 220:5</p>
--	---	--	---	---

<p><b>precise</b> [1] - 62:10</p> <p><b>predefined</b> [2] - 268:4, 270:16</p> <p><b>prejudicial</b> [1] - 99:19</p> <p><b>prepare</b> [9] - 8:18, 9:1, 9:5, 16:20, 17:7, 17:22, 18:20, 43:19, 211:4</p> <p><b>prepared</b> [1] - 42:6</p> <p><b>preparing</b> [5] - 17:9, 18:11, 20:14, 20:17, 102:1</p> <p><b>preprints</b> [1] - 69:25</p> <p><b>present</b> [4] - 39:16, 121:20, 223:16, 255:11</p> <p><b>press</b> [2] - 74:21, 75:1</p> <p><b>pressed</b> [1] - 260:18</p> <p><b>pretty</b> [2] - 39:5, 68:21</p> <p><b>prevent</b> [1] - 10:21</p> <p><b>prevented</b> [2] - 9:15, 10:19</p> <p><b>prevents</b> [1] - 8:22</p> <p><b>previous</b> [2] - 60:5, 64:1</p> <p><b>previously</b> [2] - 85:21, 157:22</p> <p><b>primary</b> [5] - 4:22, 38:4, 38:11, 112:4, 214:15</p> <p><b>principle</b> [5] - 26:3, 37:1, 158:11, 189:7, 256:17</p> <p><b>principles</b> [5] - 22:10, 22:13, 30:15, 101:2, 172:10</p> <p><b>print</b> [9] - 83:6, 84:2, 84:5, 84:15, 84:16, 88:9, 88:13, 186:1</p> <p><b>printed</b> [3] - 11:4, 85:3, 102:25</p> <p><b>printer</b> [4] - 84:2, 84:4, 84:9, 85:12</p> <p><b>printers</b> [2] - 85:14, 88:9</p> <p><b>printout</b> [1] - 86:22</p> <p><b>printouts</b> [2] - 14:13, 86:19</p> <p><b>priority</b> [3] - 59:23, 62:16, 110:8</p> <p><b>private</b> [17] - 63:15, 78:24, 80:6, 90:13, 90:15, 91:4, 92:17, 92:18, 94:2, 94:3, 94:4, 94:6, 94:8, 94:11, 98:2, 103:25, 267:8</p> <p><b>private"</b> [1] - 94:18</p> <p><b>privately</b> [1] - 94:5</p> <p><b>problem</b> [20] - 43:18,</p>	<p>44:4, 45:20, 46:15, 62:20, 84:14, 102:4, 124:6, 170:2, 170:15, 170:19, 171:20, 172:3, 207:17, 209:19, 230:15, 240:10, 252:21, 256:14, 272:16</p> <p><b>problems</b> [4] - 45:7, 45:10, 106:23, 107:4</p> <p><b>procedure</b> [7] - 65:19, 65:22, 73:1, 75:14, 75:16, 75:20, 101:24</p> <p><b>procedures</b> [4] - 67:13, 67:16, 68:6, 115:23</p> <p><b>proceeding</b> [12] - 6:4, 9:21, 10:15, 11:9, 14:1, 14:2, 19:7, 24:5, 37:7, 57:24, 85:22, 157:23</p> <p><b>proceedings</b> [21] - 4:7, 4:10, 5:14, 5:25, 6:25, 7:3, 8:8, 10:3, 11:16, 11:21, 12:5, 13:25, 14:15, 15:21, 58:7, 99:12, 99:14, 124:16, 173:17, 173:23, 275:13</p> <p><b>process</b> [19] - 7:10, 45:4, 52:24, 53:10, 57:5, 66:22, 67:2, 67:3, 67:10, 72:23, 73:5, 73:14, 74:2, 74:8, 98:24, 247:21, 257:17, 266:24, 267:7</p> <p><b>processed</b> [1] - 235:14</p> <p><b>processes</b> [1] - 53:13</p> <p><b>processing</b> [2] - 162:2, 162:5</p> <p><b>processor</b> [53] - 159:15, 159:19, 160:8, 160:9, 160:23, 163:4, 179:4, 179:6, 196:21, 204:22, 206:2, 206:8, 207:3, 207:5, 207:11, 207:12, 207:18, 207:19, 207:22, 208:5, 208:7, 208:8, 209:9, 211:1, 211:21, 211:24, 215:5, 215:16, 215:18, 217:16, 219:7, 219:8, 219:23, 224:25,</p>	<p>229:5, 229:11, 230:9, 230:19, 230:22, 244:17, 248:24, 250:10, 250:14, 250:15, 250:22, 251:9, 253:6, 253:11, 253:22, 254:11, 265:10, 267:5, 270:16</p> <p><b>processors</b> [10] - 49:24, 201:12, 207:24, 216:9, 216:24, 220:8, 229:10, 235:3, 253:3, 265:4</p> <p><b>produce</b> [1] - 189:8</p> <p><b>produced</b> [2] - 12:10, 249:14</p> <p><b>product</b> [7] - 8:13, 8:14, 8:20, 8:22, 8:24, 9:13, 9:15</p> <p><b>products</b> [2] - 6:22, 193:9</p> <p><b>professional</b> [2] - 23:18, 24:4</p> <p><b>professor</b> [1] - 54:18</p> <p><b>Professor</b> [3] - 4:17, 27:6, 27:7</p> <p><b>programming</b> [2] - 32:22, 32:25</p> <p><b>progress</b> [6] - 39:17, 52:18, 57:2, 57:9, 69:21, 90:12</p> <p><b>project</b> [35] - 40:13, 43:11, 43:16, 44:16, 44:24, 46:13, 48:17, 48:21, 50:16, 52:19, 53:3, 53:4, 53:11, 53:16, 53:18, 55:3, 55:4, 55:13, 58:18, 61:8, 67:8, 68:10, 79:21, 92:7, 93:10, 94:4, 94:6, 94:14, 94:15, 94:16, 97:6, 97:24, 98:21, 106:24</p> <p><b>projects</b> [7] - 52:19, 54:4, 54:6, 64:18, 65:10, 68:10, 106:21</p> <p><b>proof</b> [1] - 69:25</p> <p><b>proper</b> [1] - 218:4</p> <p><b>properly</b> [2] - 211:16, 250:13</p> <p><b>proposal</b> [3] - 44:2, 44:10, 44:12</p> <p><b>proposals</b> [2] - 43:22, 45:21</p> <p><b>proposed</b> [3] - 108:13, 109:9, 109:13</p> <p><b>proposition</b> [1] - 59:2</p>	<p><b>proprietary</b> [2] - 200:16, 272:11</p> <p><b>protection</b> [1] - 229:24</p> <p><b>Protective</b> [2] - 13:8, 13:13</p> <p><b>protocol</b> [5] - 51:18, 127:22, 144:6, 195:4, 200:14</p> <p><b>protocols</b> [10] - 32:8, 33:25, 34:18, 35:25, 148:13, 183:23, 203:18, 217:3, 249:1, 272:6</p> <p><b>provide</b> [5] - 13:21, 23:13, 59:17, 68:6, 113:10</p> <p><b>provided</b> [13] - 13:11, 13:12, 21:20, 24:5, 28:19, 51:20, 63:14, 64:1, 65:14, 65:20, 97:2, 107:23, 250:12</p> <p><b>providing</b> [2] - 36:4, 112:11</p> <p><b>ps</b> [1] - 82:12</p> <p><b>PTAB</b> [2] - 115:23, 255:16</p> <p><b>PTAB's</b> [1] - 258:17</p> <p><b>PTO</b> [1] - 115:23</p> <p><b>public</b> [17] - 8:12, 9:16, 21:1, 58:25, 59:25, 60:23, 62:1, 63:14, 63:16, 64:2, 64:4, 64:5, 64:11, 78:23, 94:9, 94:16, 95:19</p> <p><b>publication</b> [10] - 54:20, 61:23, 62:7, 70:13, 70:15, 71:11, 72:3, 72:19, 73:20, 74:11</p> <p><b>Publication</b> [1] - 73:24</p> <p><b>publications</b> [6] - 23:24, 70:2, 73:4, 98:10, 102:9, 271:7</p> <p><b>publicly</b> [13] - 59:14, 59:18, 61:1, 62:23, 62:24, 63:6, 63:13, 63:19, 64:9, 69:15, 77:3, 77:15, 78:7</p> <p><b>publish</b> [4] - 70:4, 71:12, 72:22, 74:12</p> <p><b>published</b> [6] - 59:24, 62:14, 73:3, 76:14, 99:1, 235:4</p> <p><b>publishes</b> [1] - 70:16</p> <p><b>publishing</b> [4] - 10:13, 11:2, 70:19, 70:22</p> <p><b>pull</b> [7] - 62:9, 71:17, 134:25, 179:18, 185:9, 192:3, 195:21</p>	<p><b>pulled</b> [2] - 28:16, 39:18</p> <p><b>purchased</b> [3] - 9:13, 26:15, 271:9</p> <p><b>purpose</b> [3] - 85:3, 175:13, 258:6</p> <p><b>purposefully</b> [1] - 200:14</p> <p><b>pursuant</b> [1] - 5:13</p> <p><b>push</b> [1] - 47:25</p> <p><b>pushing</b> [1] - 55:20</p> <p><b>put</b> [31] - 21:15, 21:21, 21:24, 22:11, 33:15, 41:7, 50:13, 52:17, 62:2, 74:14, 74:24, 84:7, 88:24, 90:2, 91:15, 92:3, 92:6, 97:14, 99:1, 153:11, 170:22, 172:15, 219:11, 234:23, 236:8, 236:10, 237:17, 239:6, 239:8, 246:2, 264:9</p> <p><b>puts</b> [1] - 65:23</p> <p><b>putting</b> [1] - 38:15</p> <p><b>puzzled</b> [1] - 251:22</p>
<b>Q</b>				
<p><b>QRR</b> [1] - 1:22</p> <p><b>qualifications</b> [2] - 23:18, 24:4</p> <p><b>quarterly</b> [1] - 55:2</p> <p><b>questions</b> [10] - 7:19, 26:3, 28:10, 34:25, 75:6, 75:9, 78:16, 139:2, 230:6</p> <p><b>quick</b> [5] - 135:4, 148:9, 155:7, 182:12, 185:9</p> <p><b>quickly</b> [4] - 28:23, 32:16, 173:2, 186:24</p> <p><b>quite</b> [36] - 11:22, 16:17, 19:21, 19:22, 21:24, 22:23, 24:21, 25:1, 30:3, 32:18, 32:21, 35:15, 39:13, 40:2, 41:3, 50:24, 76:6, 79:16, 97:9, 127:5, 127:18, 148:11, 150:20, 170:6, 172:14, 177:23, 185:21, 190:10, 192:9, 193:18, 216:6, 251:10, 253:19, 256:13, 258:16, 265:11</p> <p><b>quoted</b> [1] - 233:4</p> <p><b>quotes</b> [1] - 55:17</p>				

R				
<p><b>R&amp;D</b> [1] - 46:6</p> <p><b>race</b> [1] - 132:3</p> <p><b>radar</b> [1] - 272:20</p> <p><b>radically</b> [1] - 189:14</p> <p><b>radio</b> [2] - 165:6, 165:8</p> <p><b>raise</b> [1] - 106:13</p> <p><b>raised</b> [2] - 9:12, 23:5</p> <p><b>ramifications</b> [1] - 201:22</p> <p><b>random</b> [2] - 236:25, 237:1</p> <p><b>randomly</b> [1] - 262:14</p> <p><b>range</b> [1] - 219:25</p> <p><b>rare</b> [2] - 101:4, 268:9</p> <p><b>rate</b> [7] - 15:23, 26:6, 149:3, 154:17, 235:21, 238:18, 244:8</p> <p><b>rates</b> [3] - 235:21, 238:6, 238:7</p> <p><b>rather</b> [24] - 26:2, 26:4, 44:9, 47:24, 48:3, 53:14, 53:19, 70:1, 85:15, 95:3, 96:20, 106:11, 112:21, 115:24, 132:23, 148:12, 170:23, 184:20, 185:22, 193:25, 201:23, 238:17, 264:2, 270:20</p> <p><b>rationale</b> [1] - 81:11</p> <p><b>RD</b> [3] - 43:14, 106:20, 106:24</p> <p><b>RD24</b> [43] - 20:24, 38:13, 43:7, 43:11, 44:23, 45:8, 46:12, 48:17, 52:22, 54:5, 54:9, 55:3, 55:7, 58:18, 59:24, 60:16, 65:5, 67:8, 76:13, 78:19, 79:21, 87:15, 90:13, 92:7, 93:17, 94:4, 94:6, 94:14, 94:15, 94:16, 97:6, 97:24, 102:14, 102:22, 103:9, 103:21, 103:24, 104:6, 104:12, 105:1, 105:3, 105:16, 106:18</p> <p><b>RD2496</b> [1] - 88:23</p> <p><b>RD2496_1</b> [1] - 87:25</p> <p><b>RD2496_8.ps</b> [1] - 88:20</p> <p><b>re</b> [3] - 107:10, 147:11, 269:4</p>	<p><b>re-engineer</b> [1] - 269:4</p> <p><b>re-establish</b> [2] - 107:10, 147:11</p> <p><b>RE42,814</b> [1] - 1:13</p> <p><b>RE42814</b> [1] - 5:21</p> <p><b>reach</b> [3] - 210:5, 226:16, 265:2</p> <p><b>reached</b> [4] - 94:25, 216:2, 217:20, 265:20</p> <p><b>reaction</b> [1] - 136:6</p> <p><b>Read</b> [2] - 128:7, 142:12</p> <p><b>read</b> [70] - 15:2, 15:7, 16:25, 17:1, 19:16, 26:6, 29:15, 42:17, 71:18, 81:7, 83:18, 107:8, 114:11, 115:4, 118:6, 118:21, 120:8, 121:1, 121:24, 128:4, 130:24, 131:15, 132:24, 134:1, 134:5, 134:9, 134:14, 134:18, 135:15, 136:7, 138:4, 142:6, 148:15, 150:4, 151:7, 155:9, 155:11, 158:21, 165:15, 165:18, 165:19, 167:16, 168:6, 168:11, 186:16, 187:4, 187:22, 198:10, 200:11, 210:1, 210:8, 214:13, 221:14, 224:11, 243:10, 248:19, 248:22, 248:23, 249:2, 249:16, 249:17, 250:1, 252:22, 258:15, 271:11, 272:24, 274:3</p> <p><b>readable</b> [1] - 168:13</p> <p><b>reading</b> [8] - 110:8, 121:21, 123:17, 132:14, 146:12, 149:20, 165:13, 211:2</p> <p><b>reads</b> [5] - 212:18, 248:25, 249:2, 249:10, 250:2</p> <p><b>ready</b> [9] - 129:16, 130:16, 143:2, 143:3, 145:2, 145:19, 146:15, 153:10</p> <p><b>real</b> [10] - 27:25,</p>	<p>28:23, 32:25, 47:25, 48:13, 72:3, 88:8, 148:9, 185:9, 228:21</p> <p><b>reality</b> [1] - 266:1</p> <p><b>realize</b> [1] - 219:1</p> <p><b>really</b> [59] - 15:10, 17:12, 26:12, 26:16, 33:15, 41:15, 43:2, 47:5, 49:2, 51:15, 53:22, 54:23, 59:20, 62:10, 72:7, 72:13, 74:9, 84:18, 91:7, 92:17, 98:2, 98:13, 100:8, 114:20, 127:3, 132:5, 148:14, 158:13, 173:11, 174:25, 184:17, 185:20, 187:23, 196:3, 202:5, 202:21, 225:19, 231:22, 232:2, 234:6, 235:17, 238:3, 242:2, 244:5, 246:9, 248:18, 249:25, 251:3, 252:5, 253:2, 256:10, 265:9, 270:15, 271:10, 272:19, 272:24</p> <p><b>realtime</b> [2] - 107:10, 147:11</p> <p><b>reason</b> [20] - 7:25, 26:18, 83:23, 88:5, 88:6, 89:9, 89:23, 94:11, 100:6, 126:20, 129:20, 150:15, 170:18, 182:12, 202:21, 216:17, 236:14, 245:25, 251:21, 257:19</p> <p><b>reasonable</b> [19] - 63:2, 81:9, 107:17, 108:18, 109:7, 109:10, 109:13, 110:15, 110:20, 111:1, 111:3, 111:9, 113:8, 155:25, 163:20, 166:20, 168:4, 169:10, 261:25</p> <p><b>reasonably</b> [1] - 209:21</p> <p><b>reasoning</b> [1] - 272:2</p> <p><b>reasons</b> [10] - 22:11, 26:11, 83:23, 126:4, 212:17, 240:20, 246:8, 261:13, 263:23, 265:11</p> <p><b>recalculate</b> [1] - 27:18</p>	<p><b>receive</b> [6] - 67:20, 251:19, 254:24, 257:17, 260:21, 271:7</p> <p><b>received</b> [21] - 24:12, 25:13, 33:20, 164:13, 164:15, 164:24, 211:16, 212:8, 218:1, 218:16, 221:21, 235:12, 236:15, 237:8, 239:12, 240:7, 254:20, 254:23, 255:19, 256:3, 260:13</p> <p><b>receives</b> [2] - 164:10, 176:5</p> <p><b>receiving</b> [7] - 164:6, 164:9, 165:8, 169:12, 189:7, 191:15, 226:13</p> <p><b>recently</b> [1] - 227:18</p> <p><b>recess</b> [5] - 57:20, 111:23, 141:13, 186:5, 242:6</p> <p><b>recipient</b> [1] - 164:2</p> <p><b>recognize</b> [5] - 14:12, 14:19, 63:10, 157:24, 158:1</p> <p><b>recognized</b> [2] - 219:20, 236:19</p> <p><b>recollection</b> [3] - 20:25, 41:11, 66:4</p> <p><b>recommendations</b> [1] - 66:25</p> <p><b>reconnected</b> [1] - 50:14</p> <p><b>reconverted</b> [1] - 149:17</p> <p><b>record</b> [21] - 4:4, 4:15, 5:7, 13:17, 20:16, 20:17, 24:10, 27:17, 54:19, 54:20, 57:19, 71:4, 109:24, 111:22, 155:11, 166:8, 186:4, 242:5, 273:2, 274:5, 275:13</p> <p><b>recorded</b> [2] - 25:4, 27:19</p> <p><b>records</b> [6] - 12:1, 16:6, 16:10, 47:5, 65:23, 86:20</p> <p><b>recreate</b> [4] - 154:12, 154:25, 157:3, 169:17</p> <p><b>recreated</b> [4] - 176:15, 238:21, 245:15, 249:4</p> <p><b>rectangles</b> [1] - 200:23</p>	<p><b>rectangular</b> [1] - 49:14</p> <p><b>red</b> [1] - 152:12</p> <p><b>redirected</b> [1] - 81:10</p> <p><b>redundancy</b> [2] - 137:23, 201:17</p> <p><b>redundant</b> [1] - 196:18</p> <p><b>Ref</b> [6] - 70:16, 70:23, 71:5, 71:8, 71:11, 72:5</p> <p><b>refer</b> [8] - 44:5, 109:20, 143:23, 144:15, 148:12, 151:3, 185:8, 200:5</p> <p><b>referee</b> [1] - 98:9</p> <p><b>reference</b> [40] - 19:3, 20:25, 37:6, 37:19, 57:25, 60:8, 60:11, 62:13, 62:22, 64:10, 69:12, 70:20, 78:21, 98:14, 101:12, 102:10, 102:14, 102:21, 103:16, 115:20, 126:22, 132:20, 169:24, 170:2, 170:14, 171:4, 172:1, 172:2, 172:18, 172:20, 172:23, 178:22, 192:12, 193:20, 194:15, 195:11, 209:7, 213:3, 262:5, 263:4</p> <p><b>referenced</b> [1] - 125:3</p> <p><b>references</b> [13] - 15:19, 31:6, 82:21, 85:2, 102:13, 103:17, 126:13, 127:4, 127:20, 163:22, 187:5, 259:17, 266:21</p> <p><b>referencing</b> [1] - 103:24</p> <p><b>referred</b> [5] - 108:19, 109:2, 124:25, 159:14, 222:17</p> <p><b>referring</b> [23] - 49:10, 61:25, 73:11, 82:9, 86:8, 90:10, 100:12, 104:19, 107:7, 112:21, 114:11, 127:12, 128:6, 137:9, 138:5, 139:9, 140:21, 159:22, 180:23, 197:23, 220:24, 226:11, 244:9</p> <p><b>refers</b> [1] - 114:19</p> <p><b>refresh</b> [2] - 17:1, 182:13</p> <p><b>refused</b> [1] - 10:13</p>

<p><b>regarding</b> <sup>[1]</sup> - 65:19</p> <p><b>region</b> <sup>[2]</sup> - 211:18, 252:25</p> <p><b>register</b> <sup>[2]</sup> - 210:25, 211:2</p> <p><b>registered</b> <sup>[1]</sup> - 95:12</p> <p><b>regular</b> <sup>[2]</sup> - 32:20, 48:18</p> <p><b>relate</b> <sup>[1]</sup> - 60:16</p> <p><b>related</b> <sup>[15]</sup> - 5:14, 6:24, 23:2, 29:24, 30:1, 30:9, 37:8, 52:18, 54:4, 73:14, 97:3, 153:9, 153:13, 156:17, 275:14</p> <p><b>relates</b> <sup>[4]</sup> - 18:1, 29:11, 29:12, 60:14</p> <p><b>relating</b> <sup>[1]</sup> - 17:9</p> <p><b>relation</b> <sup>[1]</sup> - 219:22</p> <p><b>relations</b> <sup>[1]</sup> - 95:19</p> <p><b>relationship</b> <sup>[6]</sup> - 93:21, 156:22, 156:24, 157:1, 157:18, 244:16</p> <p><b>relatively</b> <sup>[6]</sup> - 23:22, 31:20, 67:17, 90:6, 216:3, 238:5</p> <p><b>Relativistic</b> <sup>[1]</sup> - 45:13</p> <p><b>relativistic</b> <sup>[2]</sup> - 45:17, 45:18</p> <p><b>release</b> <sup>[1]</sup> - 132:1</p> <p><b>relevance</b> <sup>[3]</sup> - 28:1, 61:9, 122:23</p> <p><b>relevant</b> <sup>[14]</sup> - 16:16, 23:9, 24:1, 33:13, 34:12, 49:18, 60:1, 85:1, 125:13, 125:17, 128:22, 141:2, 187:6</p> <p><b>reliably</b> <sup>[1]</sup> - 84:15</p> <p><b>religious</b> <sup>[1]</sup> - 228:21</p> <p><b>remain</b> <sup>[1]</sup> - 99:2</p> <p><b>remaining</b> <sup>[1]</sup> - 110:21</p> <p><b>remedy</b> <sup>[2]</sup> - 10:14, 252:21</p> <p><b>remember</b> <sup>[42]</sup> - 4:25, 5:6, 5:19, 6:5, 11:25, 16:6, 18:22, 20:12, 21:17, 21:23, 39:11, 42:18, 43:3, 43:25, 47:22, 48:6, 48:9, 50:20, 51:15, 56:13, 69:6, 69:7, 72:6, 74:19, 75:21, 79:14, 79:18, 81:17, 84:1, 84:7, 85:9, 88:6, 90:12, 98:1, 99:25, 125:11, 135:8, 138:17, 148:11, 195:18, 202:3,</p>	<p>235:20</p> <p><b>remembered</b> <sup>[1]</sup> - 21:14</p> <p><b>remote</b> <sup>[7]</sup> - 190:14, 208:16, 216:20, 228:18, 229:13, 243:16, 252:25</p> <p><b>remove</b> <sup>[4]</sup> - 58:18, 124:3, 146:10, 146:13</p> <p><b>removed</b> <sup>[1]</sup> - 78:25</p> <p><b>rendering</b> <sup>[1]</sup> - 108:9</p> <p><b>repeat</b> <sup>[1]</sup> - 234:25</p> <p><b>repeating</b> <sup>[1]</sup> - 112:22</p> <p><b>replace</b> <sup>[1]</sup> - 206:4</p> <p><b>report</b> <sup>[39]</sup> - 38:8, 38:11, 38:13, 38:20, 38:24, 48:2, 48:3, 51:7, 52:25, 53:1, 54:8, 54:9, 56:18, 56:25, 57:9, 58:14, 58:15, 58:17, 58:20, 59:6, 59:21, 59:24, 60:15, 60:16, 65:6, 69:21, 75:24, 76:14, 78:15, 78:19, 87:15, 102:15, 102:22, 103:21, 105:2, 105:16, 241:8</p> <p><b>Report</b> <sup>[1]</sup> - 56:12</p> <p><b>reported</b> <sup>[3]</sup> - 52:20, 53:1, 55:25</p> <p><b>reporter</b> <sup>[6]</sup> - 7:17, 31:13, 45:15, 165:22, 203:24, 275:4</p> <p><b>REPORTER</b> <sup>[2]</sup> - 205:15, 244:25</p> <p><b>Reporter</b> <sup>[1]</sup> - 275:25</p> <p><b>REPORTER'S</b> <sup>[1]</sup> - 275:1</p> <p><b>reporting</b> <sup>[1]</sup> - 66:16</p> <p><b>reports</b> <sup>[6]</sup> - 53:22, 56:10, 59:10, 66:23, 68:7, 68:9</p> <p><b>represent</b> <sup>[4]</sup> - 4:6, 4:9, 14:16, 158:25</p> <p><b>representations</b> <sup>[1]</sup> - 20:7</p> <p><b>representing</b> <sup>[1]</sup> - 158:15</p> <p><b>represents</b> <sup>[1]</sup> - 58:24</p> <p><b>reproducible</b> <sup>[1]</sup> - 83:25</p> <p><b>reproducibly</b> <sup>[1]</sup> - 84:16</p> <p><b>request</b> <sup>[3]</sup> - 222:14, 222:15, 236:21</p> <p><b>require</b> <sup>[16]</sup> - 113:25, 114:16, 114:17,</p>	<p>115:24, 117:19, 122:3, 124:7, 126:8, 133:8, 133:17, 133:20, 134:25, 146:3, 146:5, 209:13, 213:9</p> <p><b>require</b> <sup>[1]</sup> - 114:13</p> <p><b>required</b> <sup>[22]</sup> - 26:12, 30:10, 128:5, 134:4, 134:11, 134:13, 134:15, 134:18, 135:1, 135:4, 135:11, 135:15, 136:10, 146:7, 153:24, 156:5, 171:10, 188:12, 195:23, 199:7, 255:17, 259:21</p> <p><b>requirement</b> <sup>[11]</sup> - 40:6, 45:21, 123:14, 126:23, 131:21, 165:2, 172:4, 173:4, 188:3, 191:9, 272:14</p> <p><b>requirements</b> <sup>[5]</sup> - 27:22, 105:22, 123:23, 162:21, 246:2</p> <p><b>requires</b> <sup>[14]</sup> - 26:8, 64:10, 145:11, 149:11, 154:23, 156:1, 158:18, 165:13, 165:15, 165:20, 190:1, 240:13, 257:16, 261:14</p> <p><b>requiring</b> <sup>[2]</sup> - 213:7, 229:5</p> <p><b>Research</b> <sup>[1]</sup> - 91:10</p> <p><b>research</b> <sup>[10]</sup> - 38:3, 39:7, 43:14, 43:16, 44:18, 44:23, 48:25, 51:12, 52:18, 95:3</p> <p><b>reserved</b> <sup>[2]</sup> - 135:14, 136:1</p> <p><b>residing</b> <sup>[1]</sup> - 96:23</p> <p><b>resolution</b> <sup>[1]</sup> - 213:10</p> <p><b>resolved</b> <sup>[2]</sup> - 8:17, 9:20</p> <p><b>resources</b> <sup>[1]</sup> - 131:18</p> <p><b>respect</b> <sup>[2]</sup> - 61:15, 150:25</p> <p><b>respond</b> <sup>[9]</sup> - 32:16, 131:18, 136:2, 178:14, 208:14, 221:5, 229:6, 248:9, 249:10</p> <p><b>responded</b> <sup>[2]</sup> - 213:4, 261:11</p> <p><b>responding</b> <sup>[1]</sup> - 132:2</p> <p><b>response</b> <sup>[5]</sup> - 82:18,</p>	<p>108:3, 165:1, 210:19, 266:15</p> <p><b>Response</b> <sup>[2]</sup> - 19:13, 20:5</p> <p><b>responses</b> <sup>[1]</sup> - 19:16</p> <p><b>Responses</b> <sup>[2]</sup> - 20:1, 20:10</p> <p><b>rest</b> <sup>[7]</sup> - 118:13, 118:14, 163:16, 208:9, 225:16, 248:6, 264:25</p> <p><b>restrict</b> <sup>[1]</sup> - 227:22</p> <p><b>restructuring</b> <sup>[1]</sup> - 100:7</p> <p><b>result</b> <sup>[10]</sup> - 67:2, 147:8, 154:1, 174:18, 178:18, 210:25, 211:3, 236:18, 244:12, 260:14</p> <p><b>resulting</b> <sup>[2]</sup> - 150:8, 150:16</p> <p><b>results</b> <sup>[3]</sup> - 39:16, 39:18, 240:12</p> <p><b>retained</b> <sup>[1]</sup> - 46:19</p> <p><b>rethink</b> <sup>[2]</sup> - 17:14, 139:21</p> <p><b>retired</b> <sup>[2]</sup> - 39:25, 95:2</p> <p><b>retirement</b> <sup>[2]</sup> - 95:1, 95:5</p> <p><b>return</b> <sup>[1]</sup> - 225:6</p> <p><b>Rev</b> <sup>[1]</sup> - 124:24</p> <p><b>reverse</b> <sup>[1]</sup> - 156:18</p> <p><b>reversibility</b> <sup>[1]</sup> - 158:18</p> <p><b>reversible</b> <sup>[4]</sup> - 156:2, 156:5, 169:11, 169:16</p> <p><b>review</b> <sup>[17]</sup> - 12:21, 18:12, 19:12, 19:18, 52:16, 52:23, 53:9, 54:11, 55:1, 66:16, 66:17, 66:22, 67:4, 70:8, 102:7, 127:23, 256:8</p> <p><b>Review</b> <sup>[3]</sup> - 5:15, 71:2, 107:16</p> <p><b>reviewed</b> <sup>[12]</sup> - 12:8, 12:12, 12:23, 14:23, 15:1, 15:14, 20:5, 22:20, 32:18, 55:8, 55:14, 62:10</p> <p><b>reviewer</b> <sup>[1]</sup> - 66:18</p> <p><b>reviewers</b> <sup>[5]</sup> - 53:4, 53:15, 53:17, 54:22, 66:25</p> <p><b>Revision</b> <sup>[1]</sup> - 126:7</p> <p><b>RHIC</b> <sup>[2]</sup> - 42:8, 42:9</p> <p><b>Rigorosum</b> <sup>[1]</sup> - 25:6</p>	<p><b>RISC</b> <sup>[13]</sup> - 197:11, 206:1, 206:11, 206:24, 208:20, 209:7, 210:8, 210:11, 210:13, 211:19, 217:16, 250:22, 251:23</p> <p><b>rising</b> <sup>[1]</sup> - 128:22</p> <p><b>risk</b> <sup>[2]</sup> - 44:19, 237:9</p> <p><b>Robert</b> <sup>[1]</sup> - 216:1</p> <p><b>role</b> <sup>[1]</sup> - 40:8</p> <p><b>room</b> <sup>[1]</sup> - 92:11</p> <p><b>rough</b> <sup>[1]</sup> - 201:14</p> <p><b>roughly</b> <sup>[4]</sup> - 11:23, 15:5, 16:14, 80:13</p> <p><b>routed</b> <sup>[1]</sup> - 242:17</p> <p><b>router</b> <sup>[2]</sup> - 230:13, 230:24</p> <p><b>routers</b> <sup>[6]</sup> - 201:13, 201:24, 204:24, 217:19, 217:20, 250:9</p> <p><b>routing</b> <sup>[2]</sup> - 212:7, 213:9</p> <p><b>row</b> <sup>[1]</sup> - 177:13</p> <p><b>rows</b> <sup>[1]</sup> - 69:7</p> <p><b>rule</b> <sup>[4]</sup> - 53:14, 70:3, 237:6, 268:8</p> <p><b>rules</b> <sup>[7]</sup> - 75:18, 75:21, 83:9, 93:5, 156:13, 157:16, 196:19</p> <p><b>run</b> <sup>[2]</sup> - 95:20, 211:9</p> <p><b>running</b> <sup>[1]</sup> - 238:5</p> <p><b>Ruth</b> <sup>[3]</sup> - 4:23</p> <p><b>Ruth-Moufang</b> <sup>[1]</sup> - 4:23</p>
<b>S</b>				
<p><b>S-interface</b> <sup>[1]</sup> - 160:13</p> <p><b>sad</b> <sup>[1]</sup> - 48:25</p> <p><b>safe</b> <sup>[1]</sup> - 253:10</p> <p><b>sale</b> <sup>[1]</sup> - 62:14</p> <p><b>salt</b> <sup>[1]</sup> - 99:6</p> <p><b>sat</b> <sup>[1]</sup> - 55:10</p> <p><b>save</b> <sup>[1]</sup> - 129:6</p> <p><b>saw</b> <sup>[8]</sup> - 13:7, 50:7, 50:9, 51:16, 84:3, 130:5, 139:17, 182:21</p> <p><b>scalable</b> <sup>[1]</sup> - 45:8</p> <p><b>scale</b> <sup>[2]</sup> - 228:16, 272:17</p> <p><b>scaleable</b> <sup>[1]</sup> - 44:25</p> <p><b>scaling</b> <sup>[1]</sup> - 45:1</p> <p><b>scanning</b> <sup>[2]</sup> - 27:15, 27:16</p> <p><b>scenario</b> <sup>[6]</sup> - 206:21,</p>				



<p>239:10, 239:21, 262:16, 262:19, 270:4</p> <p><b>scenarios</b> [2] - 171:2, 223:18</p> <p><b>scheduled</b> [1] - 43:25</p> <p><b>scheme</b> [9] - 56:8, 99:11, 148:18, 176:17, 232:1, 265:22, 266:21, 268:18, 269:17</p> <p><b>school</b> [1] - 32:24</p> <p><b>schools</b> [1] - 30:5</p> <p><b>SCI</b> [34] - 3:10, 38:18, 41:17, 42:1, 42:20, 42:25, 45:8, 46:1, 46:3, 46:22, 46:23, 47:16, 47:20, 49:12, 103:18, 173:5, 182:8, 182:10, 182:24, 185:10, 185:16, 189:13, 190:6, 209:25, 212:11, 212:12, 219:13, 219:16, 225:13, 225:14, 228:20, 259:17, 272:5, 272:8</p> <p><b>SCI-like</b> [1] - 185:10</p> <p><b>science</b> [21] - 24:23, 25:9, 26:17, 26:21, 26:25, 27:3, 27:5, 27:7, 27:9, 27:12, 27:21, 29:7, 29:24, 30:11, 30:17, 32:18, 32:21, 33:10, 33:19, 55:19, 55:21</p> <p><b>science/computer</b> [1] - 30:7</p> <p><b>Scientific</b> [1] - 53:5</p> <p><b>scientific</b> [1] - 54:19</p> <p><b>scientists</b> [1] - 73:19</p> <p><b>scope</b> [4] - 12:18, 99:17, 101:18, 267:10</p> <p><b>scratch</b> [1] - 35:17</p> <p><b>scream</b> [1] - 231:16</p> <p><b>screen</b> [4] - 80:23, 84:3, 85:11, 272:21</p> <p><b>scrutiny</b> [4] - 53:19, 74:8, 74:25, 75:4</p> <p><b>SCSI</b> [6] - 205:7, 205:11, 205:13, 205:18, 205:22</p> <p><b>SCSIs</b> [1] - 206:14</p> <p><b>SDRAM</b> [1] - 160:10</p> <p><b>search</b> [4] - 68:13, 80:14, 80:18, 80:19</p> <p><b>searchable</b> [2] - 62:19, 90:14</p>	<p><b>searched</b> [1] - 264:4</p> <p><b>searching</b> [1] - 264:5</p> <p><b>second</b> [30] - 5:3, 7:17, 64:8, 74:17, 74:18, 82:2, 82:4, 82:7, 82:8, 98:14, 103:13, 113:23, 116:4, 116:9, 116:11, 118:20, 119:14, 119:22, 155:20, 156:15, 167:21, 167:24, 168:19, 186:10, 197:3, 236:14, 241:12, 256:13, 260:5, 260:7</p> <p><b>second-to-last</b> [1] - 168:19</p> <p><b>Section</b> [4] - 23:16, 24:6, 42:2, 112:9</p> <p><b>section</b> [10] - 43:3, 43:6, 62:18, 62:20, 142:12, 155:22, 158:24, 159:4, 192:23, 192:24</p> <p><b>sections</b> [2] - 40:20, 222:16</p> <p><b>sector</b> [1] - 9:16</p> <p><b>security</b> [1] - 80:25</p> <p><b>see</b> [79] - 13:10, 15:4, 21:8, 26:23, 28:15, 30:5, 31:5, 34:21, 37:21, 42:3, 49:13, 50:5, 50:7, 60:19, 68:24, 72:11, 74:18, 79:1, 79:7, 79:23, 82:18, 88:5, 89:8, 101:9, 102:17, 106:2, 110:11, 110:12, 113:20, 114:8, 116:4, 116:16, 116:17, 116:23, 126:25, 127:19, 128:5, 129:5, 130:17, 131:7, 132:19, 135:12, 140:6, 140:15, 143:24, 144:25, 147:1, 148:7, 148:9, 151:17, 152:4, 152:13, 152:14, 158:7, 159:5, 160:5, 161:15, 161:21, 161:25, 168:2, 170:5, 181:5, 186:2, 186:14, 186:23, 192:7, 198:17, 199:12, 201:24, 204:18, 214:12,</p>	<p>223:21, 226:25, 232:22, 245:12, 253:7, 266:18, 268:16</p> <p><b>seeing</b> [4] - 51:7, 51:10, 51:13, 101:21</p> <p><b>seem</b> [3] - 23:9, 26:21, 66:21</p> <p><b>select</b> [4] - 143:4, 145:8, 174:15</p> <p><b>selected</b> [3] - 129:18, 129:19, 217:1</p> <p><b>selection</b> [1] - 106:10</p> <p><b>self</b> [1] - 28:8</p> <p><b>self-trained</b> [1] - 28:8</p> <p><b>sell</b> [1] - 193:10</p> <p><b>selling</b> [2] - 11:3</p> <p><b>semantic</b> [1] - 225:13</p> <p><b>semantics</b> [2] - 136:13, 223:15</p> <p><b>semester</b> [1] - 34:10</p> <p><b>semicolon</b> [1] - 113:24</p> <p><b>semiconductors</b> [1] - 182:22</p> <p><b>send</b> [13] - 40:20, 41:2, 133:5, 138:20, 148:16, 165:16, 194:6, 207:2, 217:25, 223:3, 225:2, 229:3, 261:2</p> <p><b>sender</b> [1] - 225:5</p> <p><b>sending</b> [2] - 226:15, 251:18</p> <p><b>sends</b> [2] - 164:1, 167:12</p> <p><b>senior</b> [1] - 215:25</p> <p><b>sense</b> [36] - 32:13, 32:14, 33:5, 46:2, 47:2, 47:13, 83:8, 94:3, 94:5, 131:9, 137:11, 137:12, 138:18, 138:20, 140:1, 154:10, 157:2, 159:1, 164:10, 169:15, 170:21, 175:23, 176:4, 177:10, 183:16, 190:21, 200:20, 216:16, 240:5, 257:8, 260:16, 260:17, 261:16, 261:21, 269:8, 269:11</p> <p><b>sensors</b> [1] - 26:5</p> <p><b>sent</b> [17] - 39:18, 67:20, 148:19, 148:25, 176:7, 189:18, 225:3, 230:22, 239:12,</p>	<p>240:6, 240:12, 241:18, 241:22, 250:6, 250:8, 260:22, 262:18</p> <p><b>sentence</b> [15] - 37:16, 58:10, 60:5, 63:4, 63:9, 64:8, 107:15, 108:7, 114:12, 140:1, 170:7, 170:23, 186:11, 187:6, 241:13</p> <p><b>separate</b> [3] - 144:8, 225:18, 238:22</p> <p><b>September</b> [1] - 11:23</p> <p><b>sequence</b> [1] - 154:15</p> <p><b>sequences</b> [1] - 154:9</p> <p><b>Serial</b> [1] - 183:24</p> <p><b>serial</b> [67] - 116:10, 116:15, 116:21, 117:2, 119:1, 119:20, 120:1, 120:6, 121:12, 121:22, 123:4, 136:20, 140:6, 140:13, 140:18, 140:25, 141:3, 141:8, 146:25, 147:4, 147:5, 147:8, 147:17, 147:19, 148:2, 148:3, 148:6, 148:9, 148:13, 148:19, 149:6, 151:15, 152:24, 155:1, 164:17, 164:25, 166:25, 167:12, 168:1, 168:11, 168:25, 174:22, 175:2, 175:6, 175:8, 175:15, 175:17, 176:16, 176:22, 179:11, 180:7, 180:14, 180:20, 181:20, 183:22, 183:23, 184:5, 194:6, 194:9, 196:7, 234:18, 234:23, 235:6, 240:25, 258:4, 260:7</p> <p><b>serialize</b> [2] - 176:13, 191:13</p> <p><b>serialized</b> [3] - 149:13, 153:7, 154:5</p> <p><b>serializer</b> [2] - 191:18, 191:22</p> <p><b>serializes</b> [1] - 189:21</p> <p><b>serializing</b> [1] - 190:24</p> <p><b>serially</b> [2] - 149:23, 151:14</p> <p><b>series</b> [1] - 99:12</p>	<p><b>served</b> [1] - 95:22</p> <p><b>server</b> [19] - 21:21, 60:11, 78:24, 80:6, 89:16, 90:4, 90:16, 92:4, 92:17, 92:18, 94:2, 94:3, 94:4, 94:7, 94:11, 95:22, 97:2, 97:18, 102:21</p> <p><b>Server</b> [3] - 96:9, 96:12, 96:18</p> <p><b>sessions</b> [1] - 84:1</p> <p><b>set</b> [47] - 8:13, 36:10, 36:11, 44:24, 48:23, 49:17, 53:14, 53:15, 73:1, 75:18, 80:8, 93:11, 109:15, 112:10, 115:7, 120:15, 122:13, 130:8, 150:8, 151:14, 156:13, 156:14, 156:15, 156:16, 156:18, 157:24, 158:14, 158:15, 159:1, 162:20, 180:17, 185:11, 185:14, 210:3, 210:7, 219:8, 233:14, 234:3, 240:14, 247:11, 248:24, 250:8, 275:5, 275:19</p> <p><b>setting</b> [1] - 66:15</p> <p><b>settled</b> [3] - 9:3, 11:2, 71:21</p> <p><b>seven</b> [2] - 157:12, 157:13</p> <p><b>seven-bit</b> [1] - 157:12</p> <p><b>seventh</b> [1] - 116:5</p> <p><b>several</b> [9] - 4:21, 6:20, 15:2, 16:25, 53:17, 87:25, 104:19, 178:24, 204:24</p> <p><b>shape</b> [2] - 49:14, 53:23</p> <p><b>shared</b> [5] - 228:17, 228:22, 229:7, 229:18, 229:20</p> <p><b>shared-memory</b> [3] - 229:7, 229:18, 229:20</p> <p><b>shelf</b> [5] - 26:15, 71:18, 192:5, 193:3, 193:10</p> <p><b>shiny</b> [1] - 79:15</p> <p><b>Shirley</b> [2] - 1:22, 275:3</p> <p><b>SHIRLEY</b> [1] - 275:25</p> <p><b>shook</b> [2] - 19:11, 141:19</p>
---	---	---	---	---

<p><b>short</b> [6] - 23:15, 57:19, 71:6, 96:19, 132:5, 242:3</p> <p><b>shorthand</b> [2] - 205:17, 275:10</p> <p><b>shortly</b> [1] - 169:25</p> <p><b>show</b> [6] - 85:20, 171:25, 210:10, 221:13, 255:9, 272:20</p> <p><b>Showing</b> [1] - 160:2</p> <p><b>showing</b> [5] - 39:17, 107:6, 145:7, 180:6, 214:22</p> <p><b>shown</b> [35] - 50:8, 131:22, 144:18, 151:16, 152:23, 192:15, 195:11, 196:15, 196:16, 196:24, 197:15, 200:8, 200:10, 200:22, 202:13, 204:12, 204:23, 204:25, 206:18, 211:22, 212:3, 212:24, 213:17, 215:10, 216:11, 217:21, 234:18, 238:4, 239:3, 239:5, 242:18, 243:16, 245:11, 252:9</p> <p><b>shows</b> [12] - 35:14, 198:7, 199:10, 199:11, 201:15, 204:22, 222:9, 223:17, 231:6, 233:6, 254:2, 264:12</p> <p><b>sic</b> [2] - 67:21, 169:19</p> <p><b>sic</b> [1] - 164:3</p> <p><b>side</b> [13] - 142:18, 155:16, 155:18, 160:8, 160:9, 176:14, 176:17, 176:22, 217:9, 219:7, 219:23, 238:7, 244:17</p> <p><b>signal</b> [24] - 118:25, 128:10, 128:20, 128:22, 129:8, 129:18, 140:11, 143:9, 143:22, 144:2, 144:17, 144:24, 144:25, 145:3, 153:15, 154:16, 168:20, 183:4, 183:5, 183:6, 196:6, 231:23, 232:10</p> <p><b>signalling</b> [7] - 182:14, 183:14,</p>	<p>231:13, 231:14, 232:6, 232:12, 232:20</p> <p><b>signals</b> [33] - 27:19, 30:19, 122:11, 122:12, 128:6, 128:11, 129:16, 132:2, 141:2, 142:22, 142:24, 145:1, 146:14, 149:1, 153:10, 153:14, 153:17, 153:19, 153:20, 153:25, 154:8, 154:9, 154:18, 169:4, 180:5, 180:7, 180:9, 181:7, 183:2, 183:10, 231:17, 235:2</p> <p><b>signed</b> [5] - 11:4, 14:14, 15:14, 89:25, 105:11</p> <p><b>significant</b> [1] - 41:22</p> <p><b>similar</b> [4] - 23:19, 112:5, 173:5, 193:25</p> <p><b>similarities</b> [1] - 232:5</p> <p><b>similarity</b> [2] - 16:17, 193:18</p> <p><b>simple</b> [10] - 25:11, 67:17, 165:14, 209:23, 213:1, 219:4, 226:13, 246:14, 247:8, 266:2</p> <p><b>simpler</b> [1] - 139:13</p> <p><b>simplicity</b> [1] - 266:23</p> <p><b>simply</b> [3] - 43:15, 213:12, 224:5</p> <p><b>simulation</b> [1] - 49:6</p> <p><b>simulations</b> [1] - 236:7</p> <p><b>simultaneously</b> [4] - 130:16, 132:4, 251:20, 253:13</p> <p><b>single</b> [13] - 33:5, 74:2, 84:12, 117:14, 120:18, 171:7, 171:15, 202:11, 214:23, 266:25, 268:19, 269:5, 270:21</p> <p><b>single-node</b> [2] - 269:5, 270:21</p> <p><b>single-page</b> [1] - 84:12</p> <p><b>singular</b> [2] - 117:7, 120:25</p> <p><b>sit</b> [1] - 184:24</p> <p><b>site</b> [3] - 61:11, 209:13, 211:15</p> <p><b>sitting</b> [1] - 199:4</p>	<p><b>situation</b> [8] - 117:14, 166:19, 176:22, 206:17, 218:16, 223:2, 254:10, 268:14</p> <p><b>six</b> [2] - 73:25, 201:24</p> <p><b>sixth</b> [1] - 116:5</p> <p><b>size</b> [8] - 55:3, 90:8, 106:10, 236:6, 237:6, 237:8, 244:13, 265:8</p> <p><b>sizes</b> [1] - 265:15</p> <p><b>Skaai</b> [1] - 39:25</p> <p><b>sketched</b> [1] - 41:20</p> <p><b>skill</b> [15] - 28:14, 28:17, 28:22, 29:2, 29:18, 32:9, 36:6, 36:11, 36:15, 36:21, 37:3, 110:7, 204:9, 204:17, 213:6</p> <p><b>skilled</b> [1] - 63:1</p> <p><b>skip</b> [2] - 129:15, 135:14</p> <p><b>slave</b> [3] - 132:1, 177:14, 177:16</p> <p><b>slight</b> [1] - 183:13</p> <p><b>slightly</b> [4] - 136:17, 182:24, 189:6, 225:14</p> <p><b>sloppy</b> [1] - 26:15</p> <p><b>slot</b> [2] - 177:25, 178:5</p> <p><b>slots</b> [1] - 210:18</p> <p><b>slow</b> [5] - 30:19, 129:22, 148:15, 229:21, 238:7</p> <p><b>slower</b> [2] - 160:16</p> <p><b>slowing</b> [1] - 236:13</p> <p><b>small</b> [8] - 42:4, 46:7, 47:9, 55:4, 106:12, 201:5, 205:19, 245:19</p> <p><b>smaller</b> [2] - 88:12, 235:2</p> <p><b>snooping</b> [3] - 251:23, 252:1, 252:7</p> <p><b>Snoopy</b> [2] - 252:1, 252:5</p> <p><b>so-called</b> [3] - 24:18, 236:3, 265:8</p> <p><b>software</b> [7] - 85:16, 187:10, 187:20, 189:10, 191:21, 191:23, 252:20</p> <p><b>sold</b> [2] - 62:14, 272:13</p> <p><b>sole</b> [2] - 272:16</p> <p><b>solenoid</b> [1] - 42:9</p> <p><b>solenoidal</b> [1] - 42:8</p> <p><b>SOLENOIDAL</b> [1] - 42:9</p>	<p><b>solid</b> [2] - 27:14, 74:15</p> <p><b>solution</b> [4] - 107:6, 169:23, 170:1, 209:2</p> <p><b>solutions</b> [2] - 209:3, 211:6</p> <p><b>solve</b> [5] - 44:4, 45:7, 102:4, 106:22, 107:3</p> <p><b>solved</b> [2] - 84:18, 171:20</p> <p><b>solves</b> [1] - 124:6</p> <p><b>solving</b> [4] - 45:10, 170:2, 170:14, 170:19</p> <p><b>someone</b> [1] - 36:7</p> <p><b>sometimes</b> [4] - 8:17, 70:11, 84:12, 225:10</p> <p><b>somewhere</b> [6] - 31:11, 81:8, 81:10, 134:10, 210:10, 258:7</p> <p><b>sorry</b> [26] - 7:6, 10:2, 78:4, 97:21, 112:8, 125:4, 142:10, 144:13, 144:20, 151:19, 152:4, 153:1, 159:21, 166:11, 174:19, 179:19, 181:3, 189:12, 222:24, 242:22, 245:1, 251:8, 253:11, 257:12, 265:4</p> <p><b>Sorry</b> [2] - 52:5, 203:25</p> <p><b>sort</b> [5] - 29:3, 58:14, 149:21, 242:13, 263:21</p> <p><b>sorts</b> [3] - 80:7, 82:10, 229:12</p> <p><b>sought</b> [4] - 31:13, 45:15, 165:22, 203:24</p> <p><b>source</b> [3] - 201:18, 225:7, 272:16</p> <p><b>sources</b> [2] - 93:17, 272:16</p> <p><b>southbridge</b> [1] - 160:14</p> <p><b>southbridge"</b> [1] - 159:17</p> <p><b>space</b> [30] - 135:25, 157:10, 178:8, 185:1, 207:21, 207:23, 210:10, 210:11, 210:22, 211:12, 211:19, 212:23, 212:24, 224:2, 224:5, 224:8, 224:14, 225:11, 225:15, 225:22,</p>	<p>226:23, 227:8, 227:9, 227:17, 227:24, 228:9, 246:17, 265:20, 268:5</p> <p><b>spaces</b> [2] - 208:1, 268:4</p> <p><b>Spain</b> [2] - 40:4, 40:5</p> <p><b>span</b> [1] - 248:25</p> <p><b>speaking</b> [1] - 245:2</p> <p><b>spec</b> [5] - 8:15, 49:19, 49:21, 114:4, 145:8</p> <p><b>Spec</b> [2] - 124:24, 126:7</p> <p><b>special</b> [3] - 135:2, 184:13, 261:6</p> <p><b>specialization</b> [1] - 34:5</p> <p><b>specialized</b> [1] - 47:8</p> <p><b>specific</b> [4] - 34:24, 150:11, 175:12, 240:2</p> <p><b>specifically</b> [3] - 112:11, 161:4, 234:14</p> <p><b>specification</b> [32] - 49:18, 107:18, 110:10, 111:4, 111:10, 115:7, 117:24, 118:1, 123:17, 123:19, 123:20, 123:21, 123:23, 123:24, 124:5, 124:11, 125:8, 125:20, 130:4, 132:14, 132:17, 133:12, 142:5, 142:19, 149:10, 149:11, 154:10, 180:19, 184:18, 184:20, 185:8, 261:15</p> <p><b>specified</b> [5] - 79:23, 86:21, 130:13, 190:13, 235:22</p> <p><b>specifies</b> [1] - 79:25</p> <p><b>specify</b> [2] - 118:15, 164:8</p> <p><b>speculate</b> [1] - 264:8</p> <p><b>speculation</b> [1] - 185:21</p> <p><b>speed</b> [5] - 45:19, 75:3, 175:12, 183:10, 235:22</p> <p><b>speeds</b> [1] - 236:1</p> <p><b>spelling</b> [1] - 46:1</p> <p><b>spelt</b> [1] - 189:5</p> <p><b>spending</b> [1] - 8:11</p> <p><b>spent</b> [6] - 16:3, 17:22, 18:2, 39:21, 47:23,</p>
--	---	--	--	--

<p>84:1</p> <p><b>spoken</b> [4] - 21:7, 26:15, 57:10, 72:25</p> <p><b>spread</b> [1] - 55:15</p> <p><b>square</b> [1] - 237:24</p> <p><b>stage</b> [2] - 97:11, 215:19</p> <p><b>stale</b> [2] - 252:17, 252:18</p> <p><b>stamp</b> [6] - 60:20, 65:17, 65:23, 77:8, 87:16, 89:2</p> <p><b>stand</b> [4] - 52:8, 52:15, 205:18, 241:7</p> <p><b>standard</b> [40] - 46:23, 51:18, 75:20, 97:10, 101:24, 113:4, 120:12, 120:13, 120:15, 126:17, 126:18, 132:25, 150:20, 152:21, 163:2, 175:7, 181:24, 182:17, 182:23, 183:14, 185:4, 185:5, 198:9, 198:13, 200:15, 202:8, 203:18, 205:21, 209:25, 213:20, 214:4, 231:13, 231:18, 232:3, 232:7, 256:15, 256:16, 261:19, 267:15</p> <p><b>standards</b> [9] - 9:19, 30:14, 61:15, 133:1, 150:19, 161:2, 182:9, 234:13, 272:19</p> <p><b>stands</b> [4] - 42:8, 43:14, 45:18, 49:16</p> <p><b>STAR</b> [4] - 42:5, 42:8, 45:13</p> <p><b>start</b> [10] - 32:22, 116:3, 173:23, 176:11, 192:11, 210:16, 219:6, 243:18, 245:5</p> <p><b>started</b> [5] - 35:11, 43:21, 44:1, 45:23, 262:17</p> <p><b>starting</b> [7] - 18:7, 53:22, 172:6, 181:10, 224:4, 237:4, 246:5</p> <p><b>starts</b> [8] - 78:13, 86:13, 155:22, 167:20, 207:17, 229:12, 246:4, 255:7</p> <p><b>state</b> [22] - 4:16, 4:19, 5:8, 27:14, 43:8,</p>	<p>57:24, 61:5, 61:14, 122:5, 128:9, 128:21, 128:24, 129:1, 129:2, 129:10, 140:23, 144:4, 144:5, 155:24, 158:11, 220:9, 220:10</p> <p><b>statement</b> [7] - 15:15, 63:7, 79:10, 81:12, 101:25, 103:13, 188:18</p> <p><b>STATES</b> [1] - 1:1</p> <p><b>States</b> [4] - 6:10, 6:14, 6:25, 61:4</p> <p><b>states</b> [6] - 48:3, 100:5, 161:13, 162:7, 209:11, 255:10</p> <p><b>stating</b> [1] - 73:21</p> <p><b>status</b> [32] - 38:8, 38:11, 38:13, 38:20, 38:24, 51:6, 54:8, 54:15, 56:18, 56:25, 57:7, 58:15, 58:17, 58:20, 59:6, 65:5, 68:7, 68:8, 69:21, 76:13, 78:19, 87:15, 102:15, 102:22, 103:21, 105:1, 105:16, 151:10, 151:13, 152:14, 152:17, 153:4</p> <p><b>Status</b> [1] - 56:11</p> <p><b>status'</b> [1] - 153:6</p> <p><b>steer</b> [1] - 146:14</p> <p><b>step</b> [8] - 7:7, 136:18, 177:22, 208:23, 210:12, 211:9, 266:24</p> <p><b>steps</b> [2] - 118:9, 118:11</p> <p><b>stick</b> [4] - 59:21, 149:9, 174:24, 185:22</p> <p><b>still</b> [40] - 10:23, 15:8, 31:24, 44:20, 47:6, 68:15, 69:7, 79:14, 83:25, 84:7, 94:23, 95:1, 95:2, 103:25, 112:2, 125:16, 130:21, 147:9, 149:7, 150:9, 150:16, 154:1, 160:11, 182:11, 183:10, 183:15, 191:12, 194:24, 224:24, 236:24, 247:6, 253:15, 255:11, 260:22,</p>	<p>261:6, 261:9, 269:25, 270:24</p> <p><b>stop</b> [3] - 9:18, 10:13, 145:3</p> <p><b>storage</b> [7] - 26:7, 31:11, 31:15, 119:6, 119:18, 196:11, 205:21</p> <p><b>store</b> [2] - 81:7, 235:13</p> <p><b>stored</b> [3] - 63:5, 229:4, 235:12</p> <p><b>stories</b> [1] - 48:25</p> <p><b>story</b> [1] - 261:22</p> <p><b>straight</b> [1] - 268:23</p> <p><b>strange</b> [1] - 127:4</p> <p><b>Strasse</b> [2] - 5:9, 5:10</p> <p><b>stream</b> [4] - 140:14, 140:18, 141:1, 168:25</p> <p><b>Street</b> [3] - 4:23, 4:24, 5:5</p> <p><b>street</b> [1] - 5:10</p> <p><b>strict</b> [4] - 53:14, 154:10, 260:16, 272:14</p> <p><b>strictest</b> [2] - 83:8, 137:11</p> <p><b>strictly</b> [2] - 57:10, 72:24</p> <p><b>strike</b> [13] - 48:16, 58:22, 60:6, 86:4, 86:10, 123:20, 163:19, 176:10, 191:6, 215:2, 215:4, 233:10, 255:13</p> <p><b>stringent</b> [1] - 53:9</p> <p><b>strong</b> [3] - 30:10, 42:2, 45:9</p> <p><b>structured</b> [1] - 119:12</p> <p><b>student</b> [3] - 33:20, 40:4, 46:16</p> <p><b>students</b> [3] - 10:10, 34:12, 48:9</p> <p><b>studied</b> [2] - 27:5, 28:5</p> <p><b>studies</b> [2] - 35:13, 100:25</p> <p><b>study</b> [4] - 3:10, 25:16, 101:7, 270:15</p> <p><b>stuff</b> [10] - 23:24, 41:2, 42:16, 52:21, 72:4, 73:22, 83:15, 88:13, 97:12, 242:13</p> <p><b>style</b> [1] - 251:22</p> <p><b>sub</b> [6] - 80:2, 90:20, 196:18, 212:15, 227:23, 239:7</p> <p><b>sub-functionality</b> [3] -</p>	<p>80:2, 212:15, 239:7</p> <p><b>sub-nets</b> [1] - 196:18</p> <p><b>sub-web</b> [1] - 90:20</p> <p><b>sub-window</b> [1] - 227:23</p> <p><b>subaddress</b> [2] - 210:22, 225:11</p> <p><b>subclass</b> [1] - 248:21</p> <p><b>subfields</b> [1] - 73:25</p> <p><b>subfunctions</b> [1] - 31:7</p> <p><b>subgroups</b> [1] - 73:25</p> <p><b>subject</b> [10] - 6:13, 36:23, 62:15, 63:1, 63:11, 76:15, 98:23, 104:21, 219:2, 273:1</p> <p><b>subjects</b> [1] - 213:11</p> <p><b>submission</b> [4] - 19:4, 48:1, 65:22, 99:4</p> <p><b>submit</b> [9] - 44:12, 52:24, 66:18, 67:5, 67:15, 72:21, 75:14, 131:13, 251:19</p> <p><b>submitted</b> [38] - 14:14, 18:10, 18:18, 19:13, 19:19, 41:10, 51:8, 51:21, 52:1, 52:2, 54:10, 56:19, 56:24, 57:8, 57:11, 58:2, 58:24, 59:7, 60:15, 66:2, 66:7, 66:9, 67:9, 68:11, 69:16, 70:1, 70:7, 70:13, 72:18, 73:3, 75:13, 75:25, 76:3, 81:16, 88:11, 102:6, 140:25, 143:13</p> <p><b>submitting</b> [3] - 16:22, 51:12, 75:24</p> <p><b>subprojects</b> [2] - 55:6, 55:25</p> <p><b>SUBSCRIBED</b> [1] - 274:22</p> <p><b>subsegment</b> [1] - 226:17</p> <p><b>subsequently</b> [2] - 9:14, 211:21</p> <p><b>substance</b> [2] - 17:10, 141:17</p> <p><b>substandard</b> [1] - 182:23</p> <p><b>substituted</b> [1] - 217:21</p> <p><b>subsystem</b> [2] - 171:9, 270:17</p> <p><b>subsystems</b> [1] - 31:8</p> <p><b>succeeding</b> [1] - 53:12</p> <p><b>successful</b> [1] - 80:22</p> <p><b>sufficient</b> [3] - 223:10,</p>	<p>240:16, 261:23</p> <p><b>sufficiently</b> [1] - 64:11</p> <p><b>suggest</b> [4] - 103:3, 105:14, 214:8, 241:23</p> <p><b>suggested</b> [2] - 10:24, 269:7</p> <p><b>suggestion</b> [1] - 102:3</p> <p><b>suggests</b> [2] - 104:25, 238:19</p> <p><b>suit</b> [1] - 10:5</p> <p><b>Suite</b> [1] - 2:14</p> <p><b>sum</b> [2] - 18:4, 144:14</p> <p><b>summary</b> [2] - 132:23, 154:21</p> <p><b>Sun</b> [1] - 79:19</p> <p><b>sunrise</b> [1] - 79:20</p> <p><b>sunshine</b> [4] - 79:12, 79:19, 93:16, 104:1</p> <p><b>sunshine.cern.ch</b> [2] - 97:3, 97:18</p> <p><b>sunshine.cern.ch:</b> 8080 [5] - 89:16, 89:20, 90:3, 98:7, 102:21</p> <p><b>sunshine.cern.ch:</b> 8080...RD2496_1.ps" [1] - 82:11</p> <p><b>super</b> [1] - 14:5</p> <p><b>superset</b> [1] - 150:23</p> <p><b>supplied</b> [1] - 41:5</p> <p><b>supplier</b> [1] - 40:9</p> <p><b>support</b> [5] - 58:6, 135:23, 135:25, 184:15, 198:13</p> <p><b>supported</b> [1] - 136:5</p> <p><b>supporting</b> [1] - 171:5</p> <p><b>supports</b> [3] - 126:7, 184:25, 203:4</p> <p><b>suppose</b> [1] - 197:11</p> <p><b>supposed</b> [1] - 111:12</p> <p><b>Supreme</b> [1] - 10:24</p> <p><b>surprised</b> [1] - 76:5</p> <p><b>surprising</b> [1] - 27:16</p> <p><b>suspect</b> [1] - 252:23</p> <p><b>switch</b> [4] - 165:6, 177:11, 202:8, 208:12</p> <p><b>switches</b> [3] - 177:13, 201:13, 202:4</p> <p><b>switching</b> [3] - 202:1, 202:25, 272:10</p> <p><b>Switzerland</b> [1] - 61:14</p> <p><b>SWORN</b> [1] - 274:22</p> <p><b>sworn</b> [2] - 4:1, 275:7</p> <p><b>symmetry</b> [1] - 245:13</p> <p><b>synchronous</b> [3] - 128:11, 128:14, 128:17</p>
---	---	---	--	--

<p><b>Synchronous</b> <sup>[1]</sup> - 128:15</p> <p><b>syntax</b> <sup>[1]</sup> - 79:25</p> <p><b>synthesizing</b> <sup>[1]</sup> - 48:15</p> <p><b>system</b> <sup>[82]</sup> - 27:18, 27:20, 31:11, 31:15, 31:18, 31:23, 33:6, 33:14, 33:15, 35:16, 35:17, 35:19, 41:19, 41:25, 44:11, 49:8, 49:9, 50:14, 96:21, 118:24, 134:2, 134:6, 134:12, 145:14, 170:21, 171:5, 171:16, 177:19, 178:20, 180:12, 186:10, 186:13, 187:9, 187:12, 187:19, 188:12, 190:15, 190:18, 191:12, 201:4, 201:6, 201:7, 205:19, 207:6, 207:10, 208:4, 208:6, 208:10, 209:14, 210:3, 212:7, 213:7, 213:12, 216:15, 216:20, 216:21, 216:23, 227:15, 228:16, 228:17, 228:18, 228:20, 229:10, 229:19, 230:4, 230:12, 243:7, 249:20, 251:8, 252:17, 260:17, 261:6, 262:24, 267:8, 268:2, 269:5, 269:8, 269:24, 270:17, 270:21, 271:14</p> <p><b>System</b> <sup>[1]</sup> - 160:2</p> <p><b>system-level</b> <sup>[1]</sup> - 213:7</p> <p><b>systems</b> <sup>[15]</sup> - 26:4, 30:23, 31:4, 31:7, 31:21, 32:7, 33:7, 33:23, 34:16, 35:12, 35:24, 48:21, 134:11, 213:8, 272:17</p>	<p><b>tables</b> <sup>[7]</sup> - 209:15, 210:4, 230:1, 250:13, 264:1, 264:5, 266:2</p> <p><b>talks</b> <sup>[7]</sup> - 42:19, 116:8, 146:24, 191:8, 191:25, 228:3, 254:7</p> <p><b>Tandem</b> <sup>[6]</sup> - 216:2, 271:17, 271:19, 271:23, 271:24, 272:12</p> <p><b>tandem</b> <sup>[1]</sup> - 271:18</p> <p><b>Tandy</b> <sup>[2]</sup> - 271:16</p> <p><b>target</b> <sup>[17]</sup> - 115:3, 129:15, 130:15, 131:16, 143:2, 143:17, 145:2, 145:12, 145:19, 153:10, 153:16, 165:17, 211:16, 227:3, 243:8, 268:7</p> <p><b>target-only</b> <sup>[1]</sup> - 145:12</p> <p><b>targets</b> <sup>[1]</sup> - 135:25</p> <p><b>taught</b> <sup>[3]</sup> - 10:19, 10:23, 30:17</p> <p><b>TBI</b> <sup>[2]</sup> - 198:8</p> <p><b>teach</b> <sup>[2]</sup> - 34:8, 53:3</p> <p><b>teaching</b> <sup>[5]</sup> - 10:17, 10:22, 10:23, 32:19, 34:5</p> <p><b>tech</b> <sup>[1]</sup> - 47:8</p> <p><b>technical</b> <sup>[4]</sup> - 147:14, 156:6, 157:25, 173:3</p> <p><b>Technical</b> <sup>[1]</sup> - 216:1</p> <p><b>technically</b> <sup>[1]</sup> - 149:2</p> <p><b>technologies</b> <sup>[4]</sup> - 44:3, 44:22, 55:16, 272:10</p> <p><b>technology</b> <sup>[9]</sup> - 44:14, 44:19, 44:20, 45:24, 46:1, 46:16, 107:2, 202:1, 272:15</p> <p><b>teeth</b> <sup>[1]</sup> - 271:9</p> <p><b>tel</b> <sup>[2]</sup> - 2:8, 2:17</p> <p><b>telephone</b> <sup>[4]</sup> - 17:17, 122:22, 264:24, 264:25</p> <p><b>ten</b> <sup>[3]</sup> - 54:18, 70:9, 229:21</p> <p><b>tend</b> <sup>[2]</sup> - 84:23, 133:1</p> <p><b>tender</b> <sup>[1]</sup> - 8:12</p> <p><b>tenfold</b> <sup>[1]</sup> - 154:17</p> <p><b>tens</b> <sup>[1]</sup> - 178:24</p> <p><b>term</b> <sup>[28]</sup> - 32:12, 45:20, 52:12, 108:14, 110:20, 111:10, 112:16, 112:17, 112:20,</p>	<p>113:1, 115:10, 120:17, 145:21, 145:25, 155:20, 156:11, 159:17, 160:18, 160:20, 162:9, 163:21, 214:7, 227:14, 233:11, 252:4, 255:14, 261:13</p> <p><b>Terminate</b> <sup>[1]</sup> - 145:5</p> <p><b>termination</b> <sup>[1]</sup> - 232:1</p> <p><b>terminology</b> <sup>[1]</sup> - 142:23</p> <p><b>terms</b> <sup>[11]</sup> - 13:13, 51:6, 107:17, 110:6, 110:21, 112:10, 113:2, 137:17, 148:7, 159:3, 234:8</p> <p><b>test</b> <sup>[2]</sup> - 14:16, 204:5</p> <p><b>tested</b> <sup>[1]</sup> - 40:10</p> <p><b>testified</b> <sup>[2]</sup> - 4:2, 11:15</p> <p><b>testify</b> <sup>[2]</sup> - 8:5, 126:5</p> <p><b>testifying</b> <sup>[1]</sup> - 11:11</p> <p><b>testimony</b> <sup>[17]</sup> - 6:8, 6:9, 6:12, 8:1, 8:9, 9:22, 10:3, 58:3, 58:6, 59:17, 76:9, 132:8, 141:17, 269:10, 274:3, 274:5, 275:9</p> <p><b>text</b> <sup>[18]</sup> - 21:25, 38:23, 39:12, 40:19, 41:2, 64:3, 83:10, 83:13, 83:17, 83:19, 126:25, 150:2, 152:12, 172:15, 198:5, 198:6, 198:25, 205:4</p> <p><b>textbooks</b> <sup>[1]</sup> - 10:18</p> <p><b>THE</b> <sup>[122]</sup> - 1:2, 2:3, 2:11, 4:11, 31:15, 32:11, 34:2, 41:15, 45:17, 59:5, 59:20, 62:9, 64:7, 64:20, 66:14, 68:2, 75:18, 77:6, 85:6, 86:7, 87:8, 87:19, 89:4, 89:18, 91:20, 92:6, 92:22, 94:13, 95:11, 96:17, 97:5, 97:20, 98:13, 101:19, 102:25, 103:23, 104:18, 105:9, 105:19, 111:3, 111:15, 111:19, 115:19, 117:24, 118:23, 119:17, 121:10, 122:11, 124:1, 137:9,</p>	<p>137:22, 139:7, 149:9, 150:2, 150:11, 150:19, 153:3, 154:4, 155:13, 162:14, 162:25, 165:24, 166:24, 173:19, 175:19, 180:22, 181:23, 185:7, 187:22, 190:4, 191:17, 197:17, 197:25, 198:25, 199:20, 200:13, 200:25, 201:3, 202:20, 203:14, 203:25, 204:14, 205:15, 207:5, 213:22, 215:9, 215:23, 218:4, 219:1, 223:14, 226:11, 230:15, 234:22, 235:17, 239:25, 240:10, 241:7, 241:21, 243:3, 244:24, 244:25, 245:10, 245:24, 246:21, 247:15, 247:24, 248:8, 253:24, 254:23, 255:22, 256:5, 256:25, 257:19, 258:23, 259:9, 259:25, 261:18, 263:1, 268:1, 269:3, 269:16, 270:13</p> <p><b>themselves</b> <sup>[4]</sup> - 30:6, 33:2, 109:19, 184:13</p> <p><b>theoretical</b> <sup>[2]</sup> - 25:8, 27:24</p> <p><b>there"</b> <sup>[1]</sup> - 129:19</p> <p><b>thereby</b> <sup>[2]</sup> - 92:8, 240:15</p> <p><b>therefore</b> <sup>[10]</sup> - 6:6, 46:25, 94:17, 175:23, 189:10, 240:17, 241:17, 248:18, 264:8, 272:19</p> <p><b>thesis</b> <sup>[8]</sup> - 24:25, 35:17, 69:23, 98:21, 98:22, 98:24, 98:25, 99:4</p> <p><b>they've</b> <sup>[1]</sup> - 153:24</p> <p><b>THIS</b> <sup>[1]</sup> - 274:23</p> <p><b>thoughts</b> <sup>[1]</sup> - 113:11</p> <p><b>thousands</b> <sup>[2]</sup> - 45:1, 45:3</p> <p><b>three</b> <sup>[18]</sup> - 17:15, 17:16, 17:23, 25:7,</p>	<p>31:2, 33:21, 40:1, 44:8, 48:10, 52:21, 55:12, 73:21, 112:10, 193:17, 206:5, 223:21, 245:1, 264:24</p> <p><b>three-hour</b> <sup>[1]</sup> - 40:1</p> <p><b>three-page</b> <sup>[1]</sup> - 73:21</p> <p><b>throw</b> <sup>[1]</sup> - 269:11</p> <p><b>thumb</b> <sup>[2]</sup> - 53:7, 237:6</p> <p><b>Thursday</b> <sup>[1]</sup> - 1:15</p> <p><b>ties</b> <sup>[1]</sup> - 30:3</p> <p><b>timeframe</b> <sup>[6]</sup> - 55:10, 68:19, 75:12, 97:3, 99:1, 106:7</p> <p><b>timescale</b> <sup>[1]</sup> - 35:20</p> <p><b>title</b> <sup>[3]</sup> - 63:11, 101:9, 103:20</p> <p><b>TNet</b> <sup>[156]</sup> - 169:22, 169:23, 170:1, 171:14, 188:11, 188:12, 189:13, 190:1, 190:5, 190:6, 190:15, 191:9, 194:3, 194:9, 194:19, 195:3, 196:18, 197:13, 198:8, 198:10, 198:11, 200:5, 200:9, 200:13, 200:17, 200:19, 200:23, 201:3, 201:4, 202:2, 202:12, 203:3, 203:8, 203:14, 206:19, 207:11, 207:12, 207:24, 208:4, 208:8, 208:17, 208:25, 209:7, 209:13, 209:14, 209:16, 210:3, 210:5, 210:6, 210:9, 210:14, 211:12, 211:14, 211:21, 211:24, 212:1, 212:4, 212:5, 214:14, 214:16, 216:7, 216:12, 216:23, 217:16, 219:11, 219:13, 219:19, 221:6, 221:10, 221:11, 221:12, 222:10, 222:16, 223:9, 223:11, 224:7, 225:7, 225:10, 225:21, 227:7, 227:20, 227:25, 228:2, 228:9, 230:9,</p>
<b>T</b>				
<p><b>table</b> <sup>[8]</sup> - 212:1, 228:2, 263:9, 263:13, 265:23, 267:7, 267:9, 267:10</p> <p><b>table"</b> <sup>[1]</sup> - 228:5</p>				

230:18, 230:22,  
230:23, 231:4,  
233:7, 235:11,  
235:12, 235:20,  
235:23, 237:25,  
238:4, 238:17,  
241:12, 241:15,  
241:19, 241:23,  
242:25, 243:1,  
243:6, 243:23,  
244:3, 244:9,  
244:13, 244:16,  
244:22, 245:8,  
245:12, 245:21,  
245:22, 246:16,  
247:2, 247:22,  
248:8, 248:11,  
248:13, 249:2,  
249:4, 249:8,  
249:23, 250:6,  
250:7, 250:15,  
250:16, 250:22,  
251:6, 251:9,  
251:17, 253:22,  
254:8, 254:11,  
255:6, 255:13,  
259:17, 262:24,  
263:16, 265:5,  
267:14, 267:15,  
267:20, 268:2,  
268:23, 269:4,  
270:7, 271:4,  
271:14, 272:1,  
272:11  
**TNET** [1] - 169:23  
**TNet-PCI** [1] - 250:6  
**TNet-to-PCI** [1] -  
208:25  
**TO** [1] - 274:22  
**today** [12] - 8:1, 15:8,  
16:21, 17:9, 44:3,  
45:2, 97:11, 179:7,  
184:24, 224:3,  
227:16, 228:24  
**together** [29] - 15:12,  
25:20, 29:3, 31:19,  
32:1, 33:15, 38:15,  
39:18, 41:7, 44:16,  
45:3, 46:4, 47:13,  
47:25, 48:11, 50:13,  
52:20, 54:2, 54:25,  
55:24, 88:24, 93:18,  
97:14, 167:5,  
167:15, 170:22,  
203:11, 254:6  
**tomorrow** [2] -  
132:22, 186:2  
**took** [6] - 28:5, 55:2,  
67:8, 88:22, 152:4,  
270:5

**tool** [1] - 39:13  
**tools** [1] - 193:19  
**top** [22] - 4:25, 5:19,  
55:19, 56:2, 74:9,  
82:2, 135:5, 145:10,  
148:11, 152:6,  
159:19, 179:6,  
184:18, 190:16,  
192:23, 195:12,  
196:12, 206:5,  
216:14, 223:21,  
252:20  
**topology** [1] - 189:14  
**total** [2] - 17:21, 18:2  
**totally** [1] - 73:12  
**touched** [1] - 168:18  
**tough** [4] - 52:23,  
53:9, 53:19, 66:16  
**towards** [1] - 262:19  
**trace** [1] - 128:10  
**track** [2] - 7:18, 17:13  
**tracker** [2] - 42:8, 42:9  
**Trademark** [3] - 5:14,  
19:14, 19:19  
**TRADEMARK** [1] - 1:1  
**trained** [1] - 28:8  
**transaction** [242] -  
112:15, 112:20,  
113:1, 113:4,  
113:15, 114:1,  
114:20, 114:25,  
115:8, 115:11,  
116:15, 116:21,  
117:2, 117:7,  
117:11, 117:14,  
117:17, 117:25,  
118:2, 119:3, 120:1,  
120:12, 120:19,  
120:21, 121:12,  
121:15, 121:17,  
122:1, 122:9,  
122:19, 123:4,  
123:8, 124:2, 126:9,  
127:2, 127:21,  
128:4, 128:8, 129:3,  
129:4, 130:13,  
130:19, 130:21,  
131:3, 131:4,  
131:15, 132:17,  
133:18, 136:2,  
137:2, 137:3,  
137:13, 137:18,  
137:20, 137:25,  
138:6, 138:14,  
138:23, 139:8,  
139:10, 139:16,  
139:18, 139:20,  
139:25, 140:6,  
140:14, 140:18,  
140:22, 140:23,

141:2, 141:5, 142:6,  
142:7, 143:10,  
143:18, 143:21,  
145:5, 145:20,  
146:1, 146:4, 146:6,  
146:10, 146:17,  
146:25, 147:7,  
147:9, 147:17,  
147:19, 148:2,  
148:25, 149:7,  
149:22, 149:25,  
150:8, 150:9,  
150:14, 150:17,  
150:23, 151:1,  
151:13, 152:17,  
152:24, 154:1,  
154:6, 154:7,  
154:25, 155:15,  
155:17, 164:16,  
164:25, 165:11,  
165:15, 165:19,  
165:20, 167:5,  
167:17, 168:1,  
168:9, 169:1, 169:3,  
169:7, 169:18,  
174:2, 174:23,  
175:4, 175:5,  
175:15, 176:13,  
178:14, 179:11,  
189:9, 189:22,  
190:25, 191:13,  
191:15, 194:6,  
194:21, 195:5,  
196:9, 197:4, 199:6,  
206:25, 210:24,  
211:4, 211:20,  
218:11, 218:19,  
218:24, 219:18,  
219:24, 220:18,  
221:10, 221:11,  
221:15, 221:23,  
222:2, 222:4,  
222:11, 236:17,  
236:19, 236:25,  
237:3, 237:15,  
239:11, 239:18,  
239:23, 240:13,  
240:17, 240:25,  
241:17, 241:18,  
241:22, 241:25,  
242:14, 243:11,  
243:14, 243:19,  
244:12, 244:17,  
244:20, 245:6,  
245:19, 246:15,  
246:17, 247:10,  
247:13, 247:21,  
248:5, 248:16,  
249:22, 250:1,  
250:5, 250:17,  
250:24, 251:6,

251:13, 251:15,  
251:17, 254:12,  
254:21, 254:25,  
255:4, 255:16,  
255:18, 255:20,  
257:6, 257:15,  
257:20, 257:23,  
258:4, 258:7, 258:8,  
258:11, 258:20,  
259:20, 260:1,  
260:7, 260:12,  
260:22, 261:2,  
261:9, 261:10,  
261:14, 261:19,  
261:24, 262:6,  
262:9, 262:17,  
262:22, 263:15,  
269:12, 270:1,  
270:6, 270:10,  
270:23, 270:24  
**Transaction** [1] -  
142:12  
**transaction"** [3] -  
112:23, 121:15,  
255:14  
**transactions** [41] -  
114:15, 114:16,  
117:10, 117:21,  
120:5, 130:8,  
130:25, 133:6,  
133:11, 133:20,  
134:20, 135:6,  
136:22, 139:9,  
145:7, 147:3,  
164:22, 164:23,  
165:12, 167:2,  
174:3, 187:25,  
188:24, 189:2,  
189:4, 189:17,  
190:14, 190:15,  
194:9, 198:10,  
211:5, 219:14,  
227:2, 230:18,  
241:24, 244:3,  
248:20, 248:21,  
248:22, 259:6,  
259:16  
**transcript** [2] - 159:23,  
274:3  
**transfer** [2] - 135:22,  
143:24  
**transfers** [1] - 198:9  
**transform** [2] - 147:8,  
248:10  
**transformation** [1] -  
149:21  
**translate** [1] - 263:25  
**translated** [5] -  
211:24, 219:20,  
263:23, 264:3, 267:2

**translates** [2] - 198:9,  
265:25  
**translation** [28] -  
174:20, 175:25,  
190:17, 191:3,  
209:15, 210:4,  
212:2, 224:16,  
226:13, 226:14,  
228:2, 228:5, 230:1,  
239:4, 250:12,  
259:14, 263:3,  
263:20, 264:10,  
265:7, 265:13,  
265:22, 266:20,  
267:6, 267:9,  
268:11, 269:19,  
269:20  
**transmission** [13] -  
122:3, 148:6, 155:1,  
176:16, 176:23,  
180:14, 187:24,  
230:24, 231:6,  
234:18, 235:6,  
235:22, 247:9  
**transmit** [19] - 116:10,  
119:1, 136:21,  
138:15, 138:22,  
148:21, 164:17,  
164:25, 166:16,  
166:21, 166:25,  
167:4, 167:7,  
168:22, 175:2,  
181:20, 196:8,  
270:22, 270:24  
**transmit"** [1] - 166:11  
**transmits** [2] - 194:8,  
260:12  
**transmitted** [10] -  
149:6, 149:23,  
230:10, 235:1,  
239:22, 241:11,  
243:20, 244:5,  
245:22, 253:13  
**transmitting** [3] -  
164:5, 176:17,  
179:10  
**transparently** [1] -  
189:9  
**travel** [3] - 54:25,  
198:10, 201:18  
**traveling** [1] - 75:2  
**travelled** [1] - 50:17  
**TRDY** [2] - 143:3,  
144:8  
**treat** [1] - 136:1  
**tree** [2] - 177:23,  
178:25  
**TRIAL** [1] - 1:2  
**tried** [6] - 21:9, 26:1,  
26:22, 77:24, 92:22,

<p>268:2  <b>tries</b> [2] - 25:21, 265:12  <b>Trigger</b> [1] - 42:5  <b>triggers</b> [1] - 209:23  <b>trips</b> [1] - 51:3  <b>trivial</b> [4] - 72:12, 226:15, 268:10, 269:21  <b>true</b> [5] - 86:18, 156:19, 164:11, 274:4, 275:12  <b>truthful</b> [1] - 8:1  <b>truthfully</b> [1] - 8:5  <b>try</b> [16] - 7:23, 17:12, 18:3, 21:12, 25:24, 80:22, 81:7, 81:22, 171:12, 183:12, 204:18, 219:15, 221:13, 226:16, 238:21, 252:22  <b>trying</b> [33] - 7:18, 12:20, 24:9, 25:11, 41:24, 50:2, 58:21, 69:11, 91:3, 91:7, 94:10, 107:4, 114:12, 115:9, 120:10, 120:24, 125:25, 127:18, 138:24, 139:1, 171:18, 183:17, 189:3, 206:4, 214:12, 219:3, 220:10, 234:6, 240:4, 240:5, 266:22, 269:3  <b>tunneling</b> [2] - 27:15, 27:16  <b>turn</b> [2] - 85:17, 107:12  <b>turnaround</b> [2] - 131:23, 132:6  <b>turned</b> [1] - 83:24  <b>turning</b> [2] - 111:25, 156:23  <b>turns</b> [3] - 8:21, 71:21, 157:5  <b>twice</b> [1] - 50:19  <b>twisted</b> [2] - 203:22, 203:25  <b>two</b> [48] - 5:13, 5:18, 12:5, 13:25, 14:12, 14:15, 15:21, 16:13, 16:18, 16:19, 22:15, 23:6, 25:23, 30:25, 37:14, 38:2, 39:25, 42:19, 47:23, 51:2, 59:9, 73:20, 82:2, 97:23, 116:9, 119:1, 122:23, 124:16,</p>	<p>165:3, 166:24, 167:4, 167:10, 171:2, 177:15, 178:17, 193:19, 196:7, 196:17, 201:15, 203:22, 206:5, 214:23, 223:18, 228:23, 246:7, 259:17, 264:24  <b>type</b> [4] - 29:19, 130:24, 199:6, 243:19  <b>typed</b> [2] - 40:19, 80:16  <b>types</b> [1] - 133:10  <b>typical</b> [5] - 29:20, 98:9, 152:16, 234:12, 265:15  <b>typically</b> [14] - 29:17, 33:9, 70:9, 143:12, 159:16, 160:16, 160:21, 190:20, 201:11, 235:5, 236:2, 263:8, 263:9, 266:20  <b>typo</b> [4] - 197:25, 198:4, 198:19, 199:23  <b>typos</b> [2] - 15:9, 108:5  <b>TZ</b> [1] - 5:5</p>	<p>27:11, 27:13  <b>underscored</b> [1] - 83:12  <b>understood</b> [6] - 7:16, 127:12, 159:6, 162:23, 176:6, 236:17  <b>unfortunately</b> [1] - 133:1  <b>unframing</b> [1] - 238:20  <b>Unicode</b> [3] - 157:5, 157:11, 157:13  <b>unidirectional</b> [7] - 116:10, 119:1, 136:20, 153:17, 166:25, 167:15, 196:7  <b>unique</b> [1] - 209:17  <b>uniquely</b> [1] - 60:21  <b>unit</b> [10] - 119:5, 119:21, 161:6, 161:14, 161:20, 162:2, 162:5, 196:10, 196:21, 260:3  <b>UNITED</b> [2] - 1:1, 275:2  <b>United</b> [6] - 6:8, 6:10, 6:13, 6:25, 61:4, 275:6  <b>Universal</b> [1] - 183:24  <b>universities</b> [2] - 49:1, 49:4  <b>University</b> [4] - 10:6, 24:13, 25:13, 39:24  <b>university</b> [1] - 11:1  <b>unless</b> [3] - 93:8, 258:7, 263:6  <b>unlike</b> [4] - 70:2, 143:11, 174:12, 190:1  <b>unlikely</b> [1] - 269:24  <b>unpack</b> [1] - 213:14  <b>unpublished</b> [1] - 99:2  <b>untypical</b> [1] - 24:24  <b>unusual</b> [2] - 68:13, 69:19  <b>up</b> [46] - 16:5, 16:7, 16:19, 28:16, 48:23, 59:9, 72:14, 72:24, 75:8, 80:8, 80:16, 84:10, 87:24, 88:12, 98:15, 102:5, 116:18, 116:19, 127:1, 128:17, 139:10, 143:18, 144:12, 148:18, 149:4, 166:13, 171:5, 177:17, 177:20, 195:12,</p>	<p>195:21, 197:8, 210:3, 210:7, 210:10, 215:20, 240:14, 242:14, 243:22, 250:9, 262:9, 262:18, 262:23, 265:7, 270:8, 272:20  <b>uploaded</b> [1] - 210:21  <b>upper</b> [4] - 128:9, 139:23, 225:15, 265:16  <b>upside</b> [1] - 216:22  <b>URL</b> [15] - 79:23, 79:24, 82:1, 82:15, 82:17, 87:4, 87:5, 91:17, 92:19, 95:16, 96:1, 96:19, 97:3, 102:16, 104:5  <b>URLs</b> [2] - 82:2, 86:21  <b>US</b> [1] - 5:21  <b>USB</b> [1] - 160:17  <b>useful</b> [1] - 253:19  <b>useless</b> [2] - 134:2, 272:5  <b>user</b> [1] - 46:18  <b>users</b> [1] - 65:12  <b>uses</b> [10] - 46:1, 117:6, 129:8, 140:12, 172:20, 183:23, 195:3, 214:1, 233:17, 257:15  <b>usual</b> [1] - 27:1</p>	<p>19:23, 23:15, 41:9, 71:16, 71:22, 71:23, 71:24, 72:14, 77:8, 83:17, 87:22, 89:9, 125:7, 149:13, 154:5, 245:14, 272:8  <b>versions</b> [5] - 11:4, 182:24, 193:20, 198:12, 199:3  <b>versus</b> [3] - 137:18, 163:22, 173:11  <b>vertical</b> [1] - 129:1  <b>via</b> [3] - 204:24, 210:8, 222:5  <b>Victoria</b> [1] - 1:21  <b>video</b> [2] - 51:4, 181:13  <b>view</b> [18] - 28:13, 37:2, 53:25, 80:17, 85:10, 95:13, 122:25, 123:13, 126:7, 180:14, 193:11, 193:25, 197:8, 215:14, 241:11, 241:15, 247:19, 262:4  <b>viewed</b> [1] - 85:24  <b>viewer</b> [1] - 85:10  <b>VII</b> [1] - 112:9  <b>violate</b> [1] - 126:18  <b>virtual</b> [19] - 172:20, 173:11, 173:17, 173:25, 174:7, 174:12, 174:19, 175:16, 175:21, 211:13, 219:19, 228:9, 265:16, 265:21, 265:24, 267:3, 267:9, 267:14  <b>virtual-to-physical</b> [1] - 174:19  <b>visa</b> [1] - 50:21  <b>visit</b> [4] - 81:25, 82:14, 82:17, 95:16  <b>visited</b> [1] - 68:18  <b>visiting</b> [2] - 92:10, 98:6  <b>VME</b> [13] - 49:8, 49:9, 49:24, 50:3, 50:5, 128:19, 177:8, 177:10, 197:18, 197:21, 198:14, 216:18  <b>Volker</b> [4] - 3:4, 4:11, 4:17, 273:4  <b>VOLKER</b> [4] - 1:19, 4:1, 274:2, 274:21  <b>volt</b> [1] - 183:4  <b>voltage</b> [12] - 140:11, 168:20, 183:2,</p>
	<p><b>U</b></p>			
	<p><b>U.S</b> [10] - 5:13, 30:6, 50:20, 50:24, 61:6, 61:23, 62:7, 78:2, 84:17, 182:19  <b>umlaut</b> [1] - 157:8  <b>unambiguously</b> [1] - 174:11  <b>unauthorized</b> [1] - 230:3  <b>unaware</b> [1] - 59:22  <b>uncertainty</b> [1] - 44:19  <b>unclear</b> [1] - 272:12  <b>uncommon</b> [2] - 101:23, 197:2  <b>under</b> [24] - 6:13, 10:8, 13:13, 23:16, 61:23, 62:7, 70:18, 90:1, 93:6, 93:22, 94:1, 105:21, 158:5, 158:10, 158:23, 171:24, 172:13, 178:16, 185:19, 213:17, 234:6, 239:10, 261:25, 268:9  <b>undergraduate</b> [2] -</p>			
			<p><b>V</b></p>	
			<p><b>vague</b> [1] - 185:24  <b>Valencia</b> [1] - 48:8  <b>valid</b> [8] - 23:6, 23:7, 36:25, 125:18, 130:18, 202:7, 247:7, 264:23  <b>validation</b> [5] - 74:19, 228:4, 229:25, 239:4  <b>variable</b> [1] - 247:3  <b>variance</b> [1] - 267:6  <b>variant</b> [1] - 50:14  <b>variants</b> [1] - 101:9  <b>variation</b> [1] - 183:13  <b>variety</b> [4] - 32:6, 209:5, 217:3, 245:7  <b>various</b> [3] - 40:19, 65:10, 197:9  <b>vector</b> [1] - 266:25  <b>vendor</b> [3] - 8:16, 8:22, 32:3  <b>verb</b> [1] - 163:17  <b>verify</b> [3] - 125:2, 135:21, 256:10  <b>version</b> [18] - 19:22,</p>	

183:9, 184:6, 196:6, 231:12, 231:14, 231:22, 232:5, 232:15, 232:19 <b>voltages</b> [2] - 231:21, 231:25 <b>volts</b> [1] - 183:6 <b>Volume</b> [2] - 1:17, 273:4 <b>VPCK</b> [1] - 181:14 <b>VPD</b> [1] - 181:14	275:19 <b>white</b> [1] - 49:22 <b>whole</b> [25] - 19:8, 41:18, 55:23, 66:24, 67:8, 83:14, 88:10, 88:15, 112:22, 114:11, 129:25, 132:15, 132:24, 141:5, 141:8, 152:5, 172:7, 207:12, 216:21, 227:15, 238:15, 239:5, 241:25, 248:21, 252:20 <b>wide</b> [1] - 205:23 <b>Wide</b> [1] - 80:4 <b>width</b> [1] - 238:20 <b>windfall</b> [1] - 270:20 <b>window</b> [6] - 225:22, 226:22, 227:8, 227:12, 227:23, 228:1 <b>windows</b> [4] - 178:16, 210:5, 226:25, 227:3 <b>wire</b> [1] - 180:11 <b>wires</b> [3] - 154:9, 180:12, 204:2 <b>wish</b> [8] - 11:25, 52:10, 59:20, 70:5, 101:24, 106:13, 155:14, 264:8 <b>witness</b> [15] - 3:3, 4:12, 11:11, 11:13, 19:11, 62:10, 107:24, 112:24, 121:4, 141:19, 166:3, 206:23, 239:19, 271:21, 275:4 <b>WITNESS</b> [118] - 4:11, 31:15, 32:11, 34:2, 41:15, 45:17, 59:5, 59:20, 62:9, 64:7, 64:20, 66:14, 68:2, 75:18, 77:6, 85:6, 86:7, 87:8, 87:19, 89:4, 89:18, 91:20, 92:6, 92:22, 94:13, 95:11, 96:17, 97:5, 97:20, 98:13, 101:19, 102:25, 103:23, 104:18, 105:9, 105:19, 111:3, 111:15, 111:19, 115:19, 117:24, 118:23, 119:17, 121:10, 122:11, 124:1, 137:9, 137:22, 139:7, 149:9, 150:2,	150:11, 150:19, 153:3, 154:4, 155:13, 162:14, 162:25, 165:24, 166:24, 173:19, 175:19, 180:22, 181:23, 185:7, 187:22, 190:4, 191:17, 197:17, 197:25, 198:25, 199:20, 200:13, 200:25, 201:3, 202:20, 203:14, 203:25, 204:14, 207:5, 213:22, 215:9, 215:23, 218:4, 219:1, 223:14, 226:11, 230:15, 234:22, 235:17, 239:25, 240:10, 241:7, 241:21, 243:3, 244:24, 245:10, 245:24, 246:21, 247:15, 247:24, 248:8, 253:24, 254:23, 255:22, 256:5, 256:25, 257:19, 258:23, 259:9, 259:25, 261:18, 263:1, 268:1, 269:3, 269:16, 270:13, 275:19 <b>word</b> [32] - 5:10, 89:5, 94:17, 117:7, 121:19, 123:21, 137:10, 138:8, 148:20, 155:21, 158:6, 163:12, 163:13, 166:10, 166:21, 167:7, 167:19, 168:5, 168:7, 168:12, 174:11, 200:15, 203:7, 203:8, 214:9, 227:11, 238:20, 238:23, 245:1, 247:2, 257:15 <b>wording</b> [1] - 256:8 <b>words</b> [11] - 14:21, 14:22, 103:11, 131:1, 143:14, 148:18, 157:18, 162:10, 193:13, 214:2, 230:11 <b>works</b> [11] - 30:12, 30:16, 33:15, 37:4, 69:19, 101:22, 132:17, 177:19, 263:8, 264:6, 269:24	<b>World</b> [1] - 80:4 <b>world</b> [6] - 10:4, 11:17, 216:16, 224:7, 225:7, 228:25 <b>worry</b> [1] - 142:2 <b>worst</b> [1] - 74:6 <b>worth</b> [1] - 91:8 <b>write</b> [48] - 14:21, 14:22, 39:12, 41:12, 58:13, 70:5, 115:4, 128:4, 131:4, 131:10, 131:12, 131:13, 134:1, 134:5, 134:9, 134:14, 136:11, 198:10, 206:25, 210:9, 211:5, 211:20, 212:13, 212:14, 219:18, 220:1, 220:2, 220:3, 222:14, 222:15, 238:8, 243:11, 243:14, 243:15, 243:19, 244:21, 245:7, 245:18, 246:4, 246:22, 248:20, 249:17, 250:5, 251:5, 251:12, 251:15, 254:12, 254:24 <b>writes</b> [9] - 53:1, 102:5, 178:12, 212:18, 236:4, 249:10, 250:2, 252:11, 253:5 <b>writing</b> [7] - 38:15, 39:12, 48:14, 146:12, 165:13, 210:23, 229:12 <b>written</b> [14] - 15:1, 43:23, 49:20, 57:8, 59:9, 66:23, 87:3, 98:21, 108:21, 214:22, 215:25, 249:13, 252:12, 252:24 <b>wrongfully</b> [1] - 13:7 <b>wrote</b> [4] - 68:9, 78:10, 113:20, 241:8 <b>Wu</b> [2] - 48:6 <b>www.cern.ch</b> [2] - 90:22, 95:16 <b>www.ibm.com</b> [1] - 80:16	<b>Y</b> <b>yards</b> [1] - 239:5 <b>year</b> [11] - 11:23, 11:24, 34:15, 35:1, 35:6, 50:19, 51:3, 56:6, 70:11, 70:12, 72:6 <b>years</b> [16] - 21:23, 31:2, 33:21, 34:9, 35:7, 35:8, 40:23, 43:19, 44:7, 47:6, 53:17, 73:16, 78:9, 78:10, 97:15, 272:18 <b>years'</b> [1] - 54:18 <b>yell</b> [1] - 231:16 <b>Young</b> [1] - 29:16 <b>young</b> [1] - 231:11 <b>yourself</b> [1] - 35:22
<b>W</b>				
<b>Wait</b> [2] - 236:12, 253:6 <b>wait</b> [12] - 7:20, 9:17, 70:25, 146:20, 236:12, 236:24, 266:7 <b>wait"</b> [1] - 236:22 <b>waiver</b> [1] - 50:23 <b>wakes</b> [2] - 177:20, 215:20 <b>walk</b> [1] - 195:7 <b>wants</b> [7] - 69:22, 74:5, 131:9, 197:12, 242:10, 243:14, 249:14 <b>war</b> [2] - 179:1, 228:21 <b>Washington</b> [1] - 2:6 <b>watch</b> [1] - 253:4 <b>ways</b> [7] - 31:17, 156:20, 163:7, 167:13, 179:10, 210:20, 228:13 <b>weak</b> [1] - 100:25 <b>weakly</b> [1] - 101:4 <b>web</b> [11] - 78:24, 80:4, 80:6, 81:5, 85:8, 90:13, 90:14, 90:20, 90:21, 98:2 <b>Web</b> [1] - 80:4 <b>web.archive.../web</b> [1] - 82:9 <b>website</b> [4] - 95:17, 95:19, 95:21, 104:1 <b>websites</b> [1] - 81:7 <b>weekly</b> [1] - 53:21 <b>weird</b> [1] - 115:23 <b>welcome</b> [2] - 34:25, 141:15 <b>well-defined</b> [1] - 261:19 <b>well-known</b> [1] - 232:18 <b>what-if</b> [1] - 256:5 <b>what-not</b> [1] - 83:12 <b>whatsoever</b> [1] - 83:7 <b>WHEREOF</b> [1] -				
<b>Z</b>				
<b>Z80</b> [1] - 35:10 <b>zero</b> [2] - 222:18, 244:10 <b>zeros</b> [3] - 246:18, 246:21, 247:5 <b>zip</b> [2] - 4:24, 5:5 <b>zones</b> [1] - 54:24				
<b>€</b>				
<b>€100,000</b> [1] - 8:25 <b>€200,000</b> [1] - 9:13 <b>€250</b> [1] - 15:25				
<b>X</b>				
<b>XP</b> [5] - 180:19, 181:12, 181:17, 193:5, 193:16				